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AUTOMOTIVE INDUSTRIES

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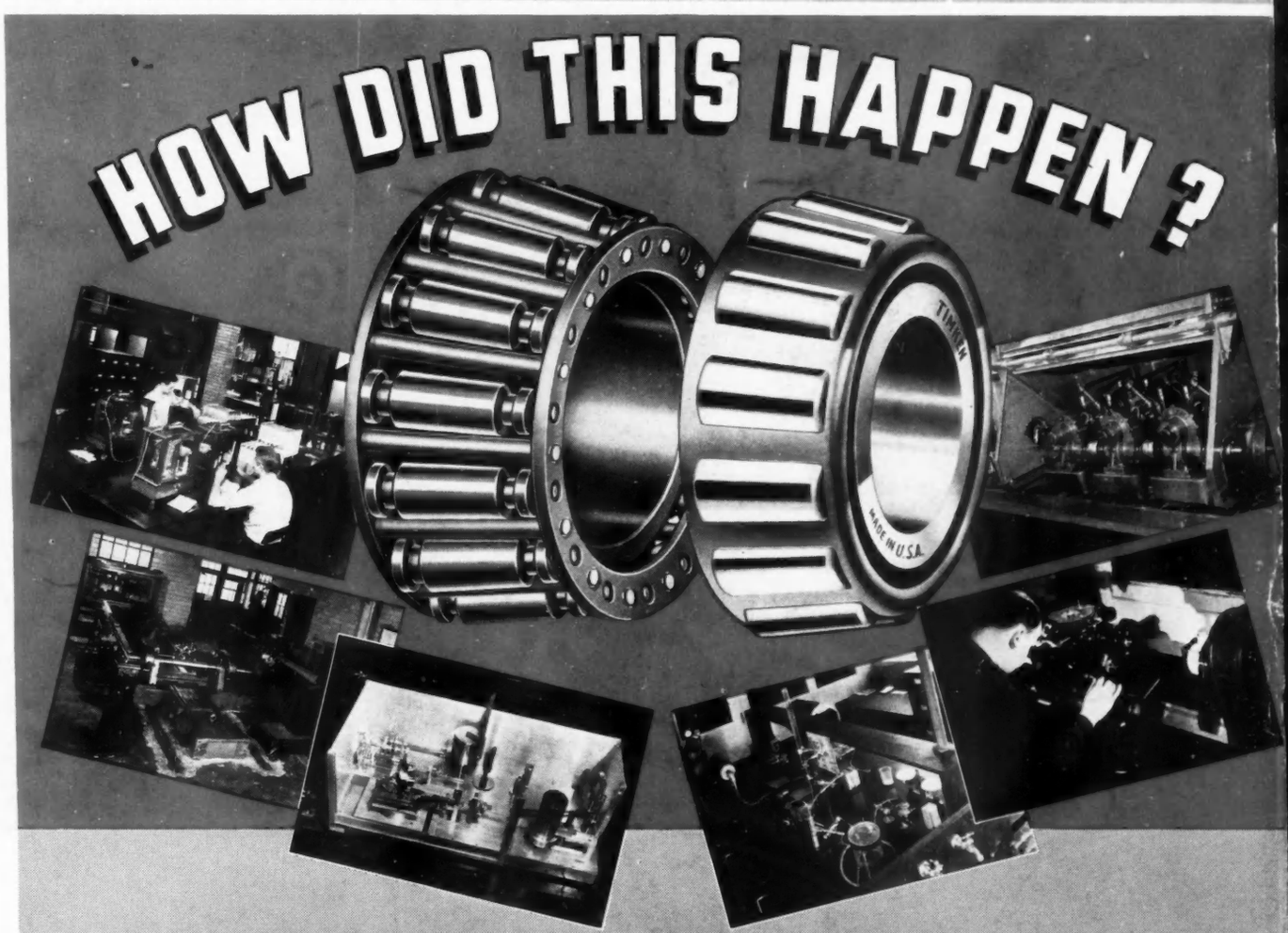
JANUARY 15, 1940



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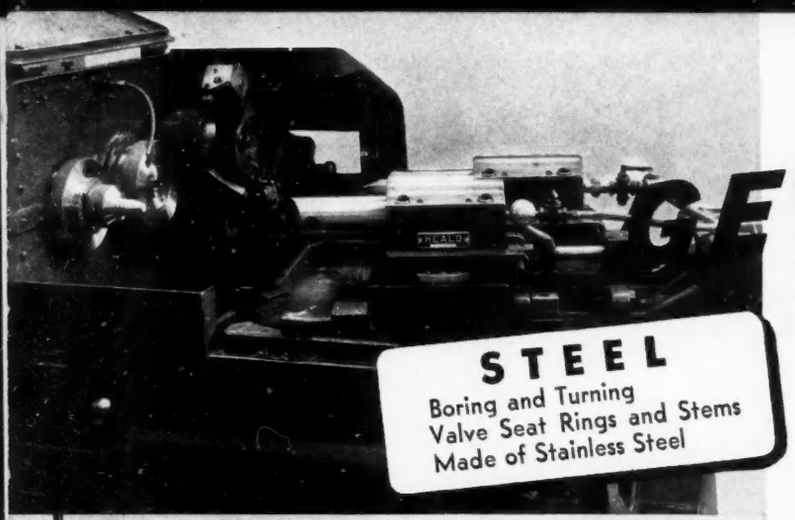

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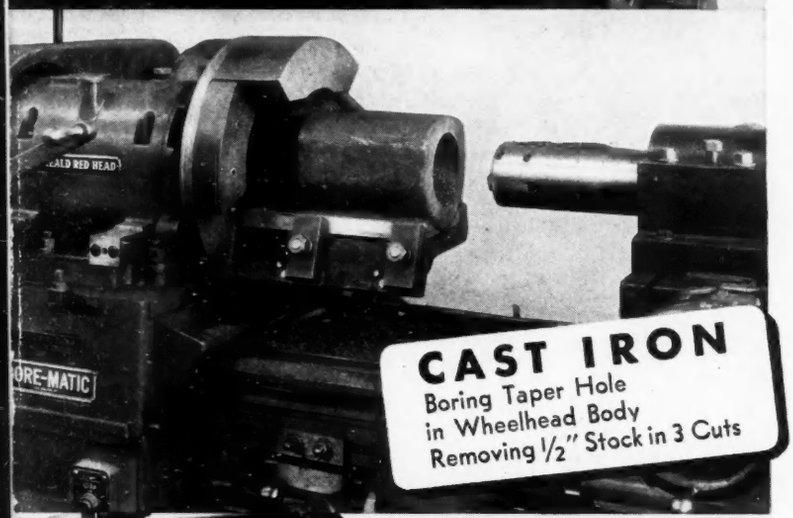

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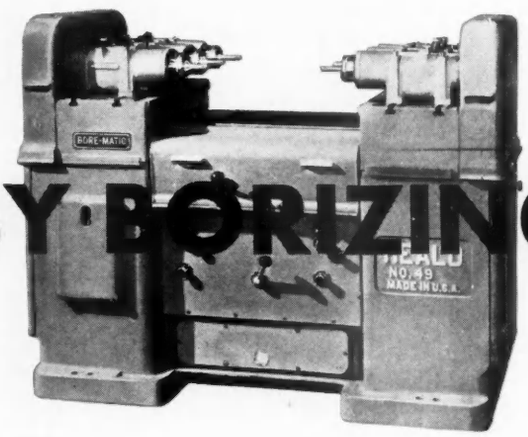

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 82 Number 2

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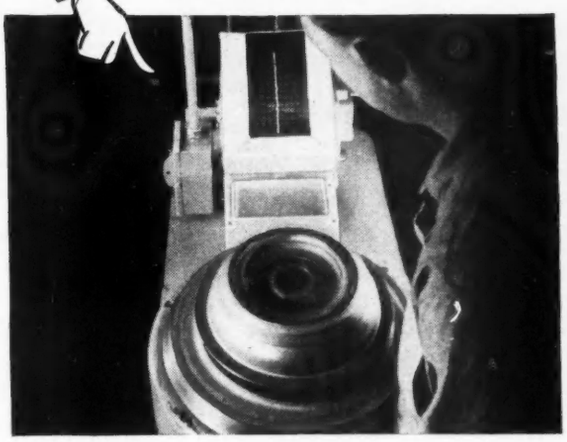

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STANDARD OF AMERICA — WORLD WIDE SERVICE

IN THIS ISSUE . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.
Volume 82 Jan. 15, 1940 Number 2

BANTAM BEARINGS CORP., has appointed Hazard Advertising Corp., New York, to handle its advertising effective Feb. 1. Plans for 1940 are now being completed and an intensive campaign in trade, industrial and general business publications comprises a major part of the program.

Announcement of a considerably augmented advertising program on Auto-Lite Spark Plugs has been made by Frank A. Nealon, general sales manager of the merchandising division of Electric Auto-Lite Co. The account is handled by the Detroit office of Ruthrauff & Ryan, Inc.

The 1940 Auto-Lite advertising campaign provides for the increased use of four-color announcements in the national magazines, ten of which are now on the list. The farm paper list is being increased by the addition of a number of media scheduled to feature merchandising plans to aid the business of spark plug dealers in rural sections. Additions have been made to the lineup of automotive trade and vocational publications which will carry Auto-Lite spark plug copy in the new year.

Continuation of Auto-Lite's successful "Parade of Stars" promotion is also planned on an even larger scale for 1940 than in previous years. The movie star featured in the 1940 program is Ann Sheridan of Warner Brothers productions.

R. E. Dietz Co., lamp and lantern manufacturer, is marking its 100th anniversary with special insert advertising in trade magazines. Lee-Stockman, Inc., advertising agency, directs the company's campaign.

A new automobile type of storage battery has been announced by U.S.L. Battery Corporation, a Division of Electric Auto-Lite Company, Toledo, Ohio. The elements of the battery are said to be made up with a new patented active material to which the name Activite has been applied, and which is said to have greater energy-storing capacity than the active materials of the conventional lead battery.

GENERAL

Has Unionism Anything to SELL Us? **47**

In this article by Julian Chase the author points out the place of the Labor Union in the scheme of affairs and how they can SELL themselves to the country. Another new note on the labor situation that makes enlightening reading.

GENERAL

A Decade of Development in the Automotive Field **50**

During the last ten years many diversities have come and gone in things automotive. Turn to page 50 of this issue and you will find both a pictorial and chronological presentation of the innovations that have come forth during that period.

GEAR DESIGN

Suggested Modifications Teeth Formula **56**

Under this same title P. M. Heldt presented an article in the Oct. 15 issue of AUTOMOTIVE INDUSTRIES. A great deal of interest has been manifested in his efforts since that time so in this issue he brings up the subject again with further developments and contributions from some of his correspondents.

NEW MARKETS

Scooters Open New Automotive Fields **67**

Herbert Chase has made occasional contribution to these columns and in this issue he treats the growing field that the introduction of scooters has developed. In general this related industry is little known so that the new markets for parts and materials pointed out here come somewhat in the nature of a surprise.

Business in Brief **49** **Production Lines** **65**

Just Among Ourselves **55** **Men and Machines** **70**

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News of the Industry **77**

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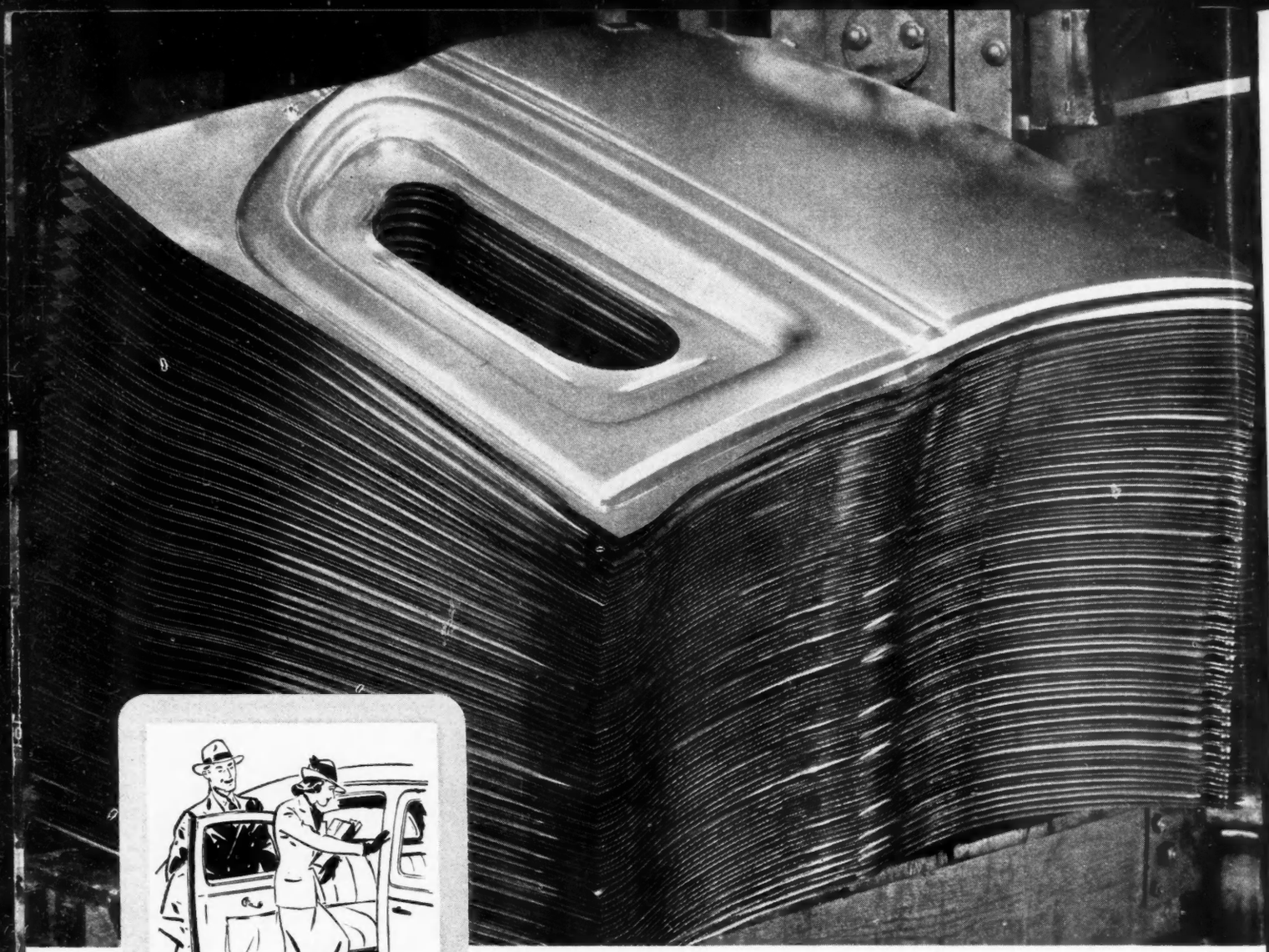

Doors to the Open Road are made of INLAND SHEETS..

The cars that fill today's highways are sturdier, safer, more beautiful because they're built of steel. And here, particularly, American leadership in engineering and manufacturing sets the pace for the rest of the world.

For years, Inland metallurgists have coöperated with American motor car builders in producing cold rolled sheets suited to their specific requirements for deep drawing, and for fine finish and other qualities. That is why, beneath the sleek lines of many of the best-known automobiles, are found the sheets that come from Inland's mills.

In serving many other industries as well, the Inland staff is constantly on the alert to produce better steels to suit each manufacturing method. It is wise, from time to time, to discuss your requirements with Inland Steel men. A request from you involves no obligation.

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AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 82, No. 2
January 15, 1940

Has Unionism Anything to *SELL* Us?

Instead of Using Everything from Brickbats to Babies to Enforce its Demands

By JULIAN CHASE

IF ORGANIZED labor sees itself and really gives a hoot whether or not the rest of us see it as a plus factor in our economic life, it has a selling job to do. It has a big selling job to do. It has before it the stupendous task of persuading us that we the people—manufacturers, distributors and consumers; bankers, industrialists, farmers and shopkeepers; food-eaters, clothes-wearers, home-owners, home-renters, housewives and husbands—should recognize and accept unionism as a helpful rather than a hindering force in our social and economic development. It has to convince us that it is a positive factor in raising the *standard* of living and not merely a lever for boosting the *cost* of living. It has the job of showing us, if it can be shown, that we should look upon it as a beneficent contributor to our national and individual well-being. The kind of selling required to do that job calls for sales equipment comprising something other than bludgeons.

If unionism as it is has something to offer that we should gladly accept, we can be shown and we can be persuaded by demonstration and by reasoning, but, while we can temporarily be bludgeoned into forced acceptance, we cannot be clubbed into wholesome and continuing conviction. Furthermore, as our labor leaders might well note, with Americans constituted as they are, persistent clubbing is more likely to induce obstinacy than it is to produce acquiescence. With prolonged use of the kind of sales instruments that have been employed to further the cause of unionism, the job of convincing us that it is an institution which we should uphold and foster becomes progressively more difficult. We shall soon conclude, if we haven't already made up our minds about it, that there is something funda-

GIVE US A CHANCE FOR BETTER FOOD AND A BETTER LIFE
OUR DADS WILL WIN! Join the Union
MY DADDY IS A UNION MA
MY DADDY STRIKES FOR US LITTLE TYKES ON TO VICTORY
OUR DADS WILL WIN! Join the Union
WE'RE BEHIND OUR DADS 100%

The phrases on the signs are American, but enlisting children in the class struggle is a product of European totalitarianism, which hardly seems acceptable to most of the nation.

mentally wrong with unionism if it has continuously to be supported by threats; by coercion and intimidation; by strikes, slow-downs, picket lines and boycotts; by the destruction of property and the cracking of heads.

If unionism is good for us, why can't it be sold to us, let us say, more like life insurance in which 60 millions of us have willingly and more or less eagerly invested 33 billion dollars of our savings? No one was threatened or coerced; no one was struck, picketted, boycotted or had his head cracked while that selling job was being done, and whether or not there was bread for the sellers' tables and shoes for the sellers' babies depended on the success of that selling effort.

Can unionism be sold to us like improved machinery which is offered and gladly accepted as a means for providing increased production at reduced unit cost, better products at lower prices, and greater availability of useful goods to a larger portion of our population?

Can unionism be sold to us as an agency for the promotion of industrial stability; as a maker of jobs and a creator of individual opportunity; as a stimulator of individual initiative; as a provider of more skillful and more reliable workers upon whom we can constantly depend for efficient and effective effort in the conduct of the nation's business?

Can unionism be sold to us as an upholder and safeguarder of fundamental Americanism, as a champion and protector of individual and minority rights, as an uncompromising advocate and supporter of the right of *every* worker to "that freedom of choice and action which is justly his?"

If unionism had the material for a sales campaign built along those lines, it could be easily sold and would be readily accepted. But unionism, as we see it today, surrounded by its atmosphere of industrial strife, its minority strikes, its slow-downs, picketting, internecine struggles, its restrictions, demands and threats, stands, unattractively to say the least, as something which finds for itself a most reluctant acceptance and that only a take-it-or else basis. Such things cannot be sold. They can only be imposed by pressure.

In plotting the gradations of intensity in forceful persuasion, it is difficult to find the point at which unionism's present propagating methods end and gangster methods begin. That is unfortunate. It is most unfortunate for organized labor as a whole. It is unfair undoubtedly to a large majority of unionized workers. But it is true. Racketeers and unenlightened labor leaders may be directly responsible but, if unionism is really democratic as its leaders would have us think, the rank and file of organized labor must accept indirect responsibility for permitting themselves to be so unfairly represented.

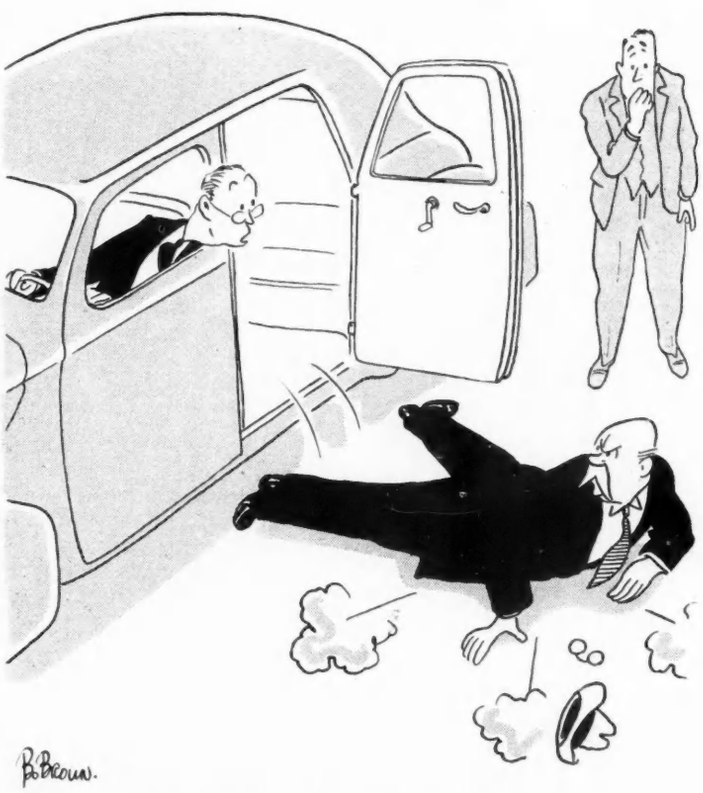
Today we do not willingly accept unionism. It is forced upon us. And when we get it what do we get? What some of us get may not be so bad but what some others get is really pretty terrible. What exhibitors at the New York World's Fair got, to take just one example, has been recorded many times. Summed up concisely it makes a staggering presentation which should be regarded as required reading by everyone interested in labor matters; and who is not? It might be well if our two outstanding labor leaders were compelled to read it aloud in public.

What happened at the World's Fair has happened in varying degrees through nearly all of industry. The prevalence of practices similar to those there employed has finally forced even our present administration to do something about them. The anti-trust laws have been dusted off and given a second reading. It is beginning to be realized by our law enforcers that restraint of interstate commerce is still restraint if the restraining is done by those who stand in the front ranks of organized labor. Our Department of Justice has said something of that kind lately and, while only a few of unionism's doubtfully legal deeds are referred to, it will be well if we all, for encouraging emphasis, read and reread the list of unionism's practices which our Assistant Attorney General believes "are unquestionable violations of the Sherman Act, supported by no responsible judicial authority whatsoever."

Next we can expect government to do something about the arbitrary abridgement of individual and minority rights which has characterized unionism's organizing activities under the stimulus of

(*Turn to page* 86)

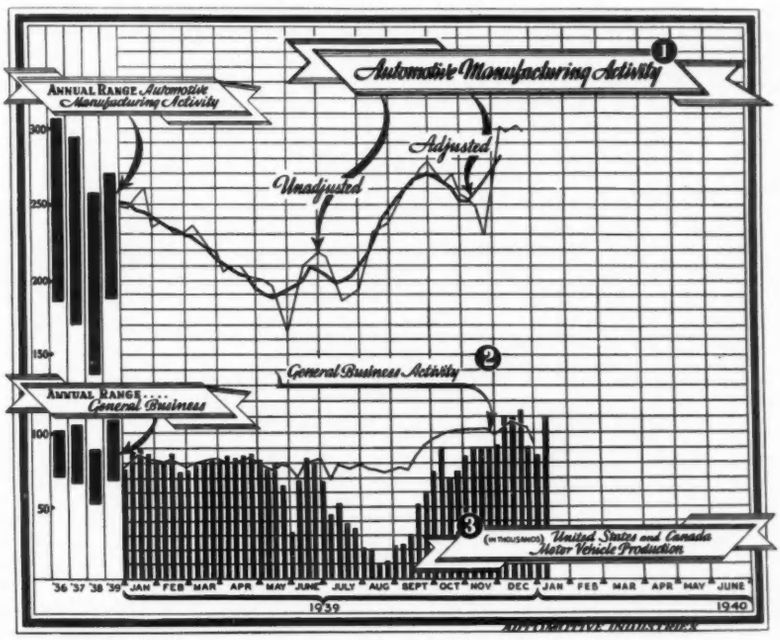
The Brass-Hat Rack



"This model has no running board, sir!"

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive general business charted

January Should Reach 450,000

PRODUCTION of cars and trucks for the first two weeks in January should run fairly close to 200,000 units according to preliminary estimates[3] based on an early check of factory schedules.

Output during the week ending Jan. 6 totaled approximately 85,000 cars and trucks, a slight drop from the preceding week but attributable largely to the loss of one day because of the New Year's holiday and closings for inventory in several plants.

Preliminary estimates of production for the week ending Jan. 13 indicated that, with most plants returning to their previous five-day schedule total output probably would exceed 100,000 uints so that the total for the first two weeks should run close to the 200,000 figure mentioned above.

Total January output should be approximately equal to that of December, which has been estimated at between 445,000 and 450,000 and because the calendar gives January several extra working days, the total may even exceed December slightly. Production during the first week of January was affected to some extent because Willys and Studebaker plants were closed for inventory while Packard resumed operations after being closed for inventory during Christmas week.

Industry leaders continue to be optimistic over sales prospects for 1940 with most producers beginning the year with large banks of unfilled orders in spite of a final quarter for 1939 which broke production and sales records of long standing. December reports received from a number of manufacturers indicate that the month as well as the final quarter was an unusually satisfactory one.

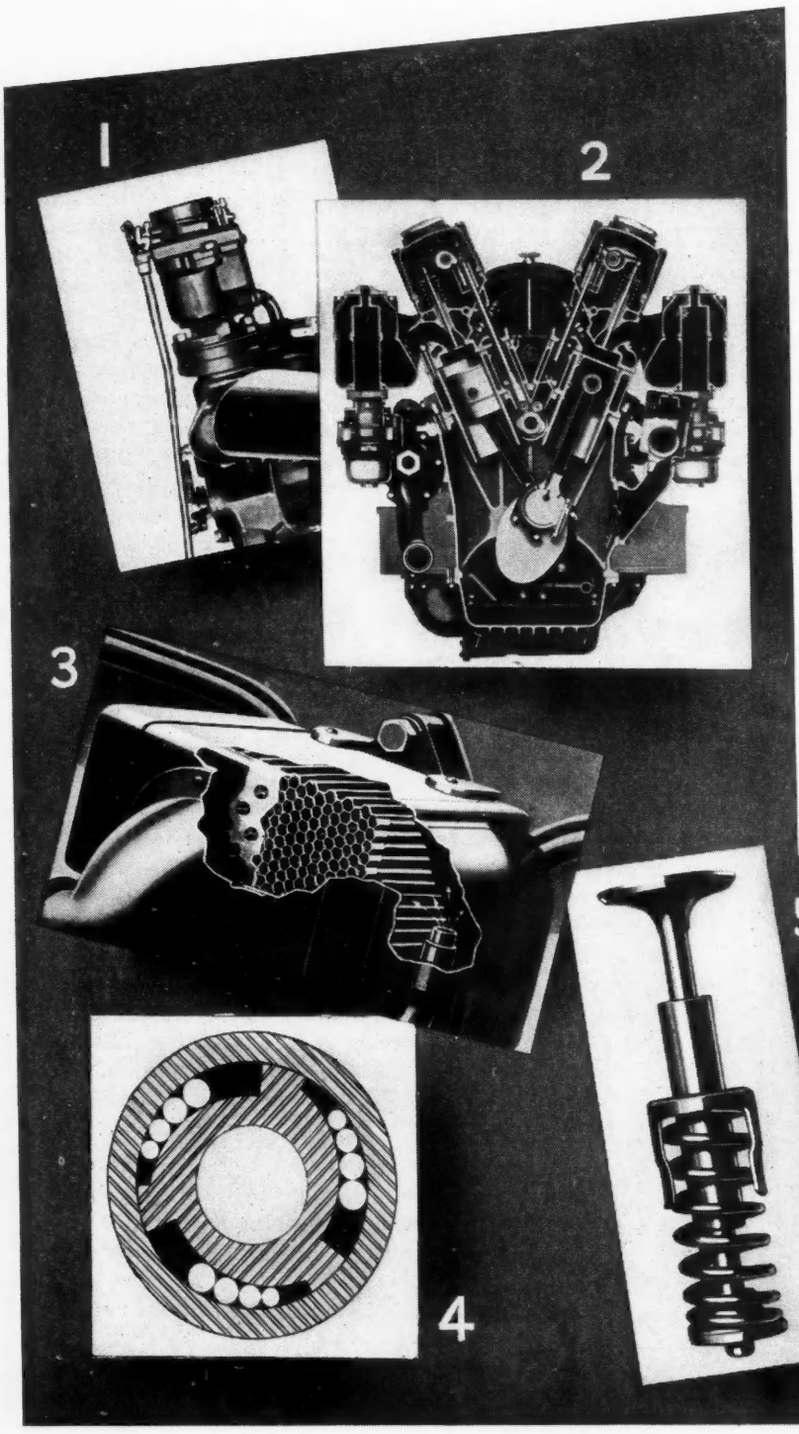
Ford's December production totaled 92,389 Ford cars and trucks and Mercury cars, the best month since June, 1937. The company's 1939 production exceeded 1938 by 215,120 units. Hudson reported that last quarter sales were more than double those of the same period in 1939 while Buick and Studebaker enjoyed the largest last quarter in their respective histories. Chevrolet's sales during the second 10 days of December were the highest mid-month record since May, 1937, while Nash reported that sales of 1940 models to date have equalled sales during the first six months of 1939 model year with December sales its best in 10 years. Cadillac-LaSalle shipments were up 21 per cent over 1938 for the company's third best year and last quarter production was largest in its history. Pontiac's final quarter also was the largest in its history and sales for 1939 were 60 per cent ahead of the previous year.

AUTOMOTIVE MANUFACTURING ACTIVITY touched a new ceiling during the week ended Dec. 23 with the unadjusted index soaring to 302. During the week ended Dec. 30, the unadjusted index dropped four points to 298.

The adjusted curve, lagging four weeks behind its unadjusted partner plotted in the graph above, sought somewhat higher ground during the weeks ended Dec. 2 and Dec. 9 to reach the index levels of 273 and 282, respectively.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp., New York. 1926 — 100; [3] Estimated by J. A. Laansma, Detroit News Editor, AUTOMOTIVE INDUSTRIES.

A DECADE of Automotive



Since 1928 many innovations have been introduced in the automotive field. Listed here are many of them in the order of their introduction, with many illustrated to show as well as record the decade's progress.

1929

Laminated safety glass (Duplate on Cadillac).

Downdraft carburetor (Stromberg on Chrysler). (Fig. 1)

1930

Sixteen-cylinder stock car (Cadillac). (Fig. 2)

e Development

Oil cooler on stock cars (Hupmobile, Buick). (Fig. 3)

Freewheeling unit (Warner Gear, on Studebaker). (Fig. 4)

Dampers for valve springs (Studebaker). (Fig. 5)

Tin-plating of cast-iron pistons (G. M. lines).

Automatic zero-lash valve tappets (Cadillac). (Fig. 6)

1931

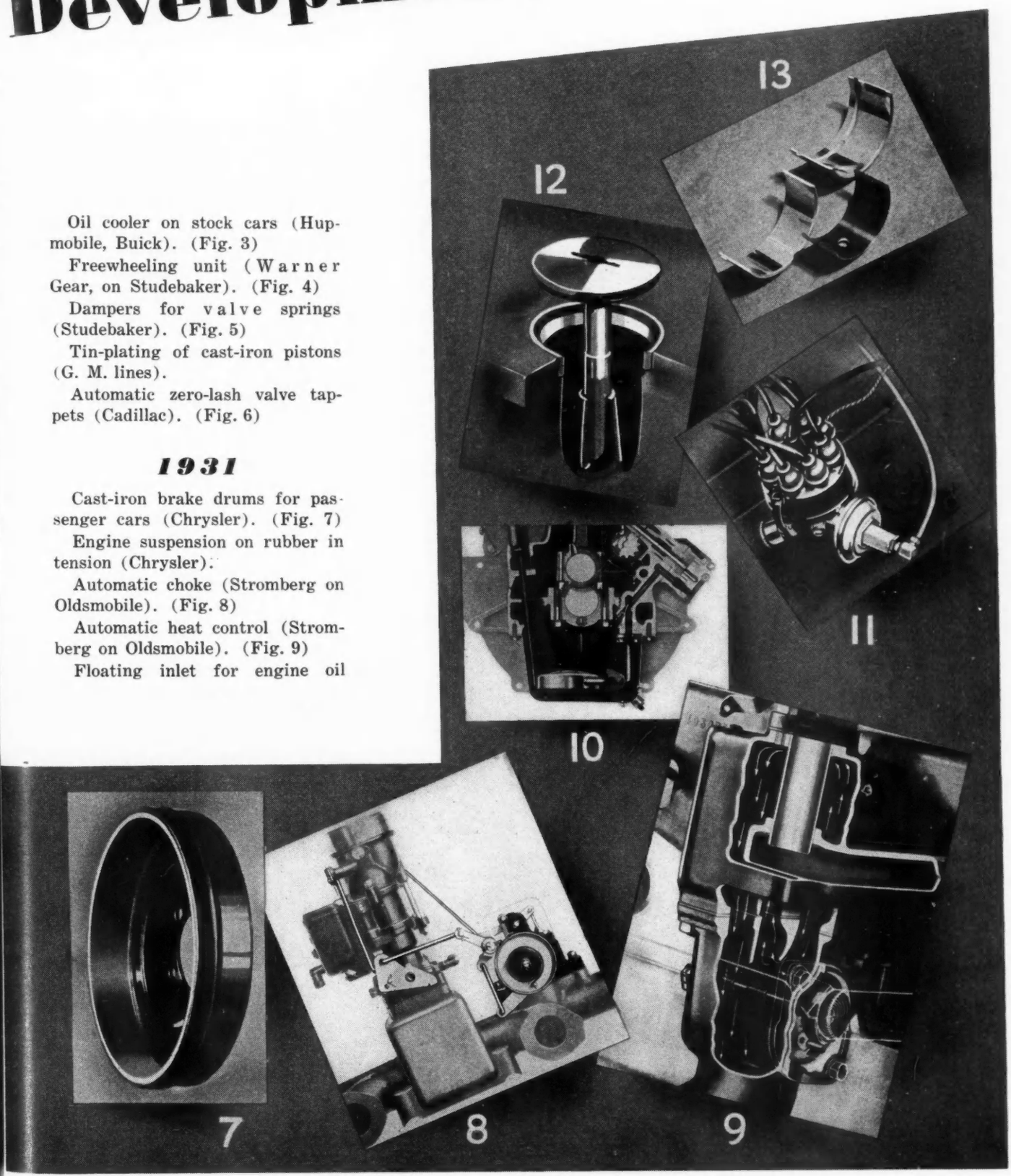
Cast-iron brake drums for passenger cars (Chrysler). (Fig. 7)

Engine suspension on rubber in tension (Chrysler).

Automatic choke (Stromberg on Oldsmobile). (Fig. 8)

Automatic heat control (Stromberg on Oldsmobile). (Fig. 9)

Floating inlet for engine oil



A DECADE of Automotive Development

pump (Float-O on Willys). (Fig. 10)

Automatic spark timing by inlet vacuum (Delco-Remy on Plymouth). (Fig. 11)

Valve-seat inserts in cast-iron cylinder blocks of passenger car engines (Chrysler). (Fig. 12)

Steel-back precision bearings (Cleveland Graphite Bronze on Studebaker). (Fig. 13)

14-Mm. spark plug (AC).

Shock-absorber control from seat (Packard).

Aluminum cylinder heads on passenger-car engines (Graham).

1932

Shackle bolts with threaded bearing surfaces (Cadillac, Buick). (Fig. 14)

Cast iron camshafts (Hudson).

1933

Spoked stamped steel wheels on passenger cars. (Fig. 15)

Body ventilation by pivoted window sections (Fisher Body). (Fig. 16)

Anodized aluminum-alloy pistons (Lincoln).

Semi-automatic transmission (Reo). (Fig. 17)

All-helical-gear transmission (Chrysler). (Fig. 18)

1934

Front independent suspension in stock cars (General Motors and Chrysler). (Fig. 19)

Automatic overdrive (Warner Gear, on Chrysler). (Fig. 20)

Engine mounted over front axle to reduce frequency of chassis oscillation (Chrysler). (Fig. 21)

Cast Crankshafts (Ford). (Fig. 22)

Tubular-frame seats (Chrysler). (Fig. 23)

Body suspension on coil springs (General Motors and Chrysler).

1935

Cadmium-silver-copper bearings (Federal-Mogul on Pontiac).

Steel roof on automobile bodies (General Motors). (Fig. 24)

Semi-centrifugal clutch (Long Division of Borg-Warner Corporation). (Fig. 25)

Die-cast radiator grilles (Oldsmobile). (Fig. 26)

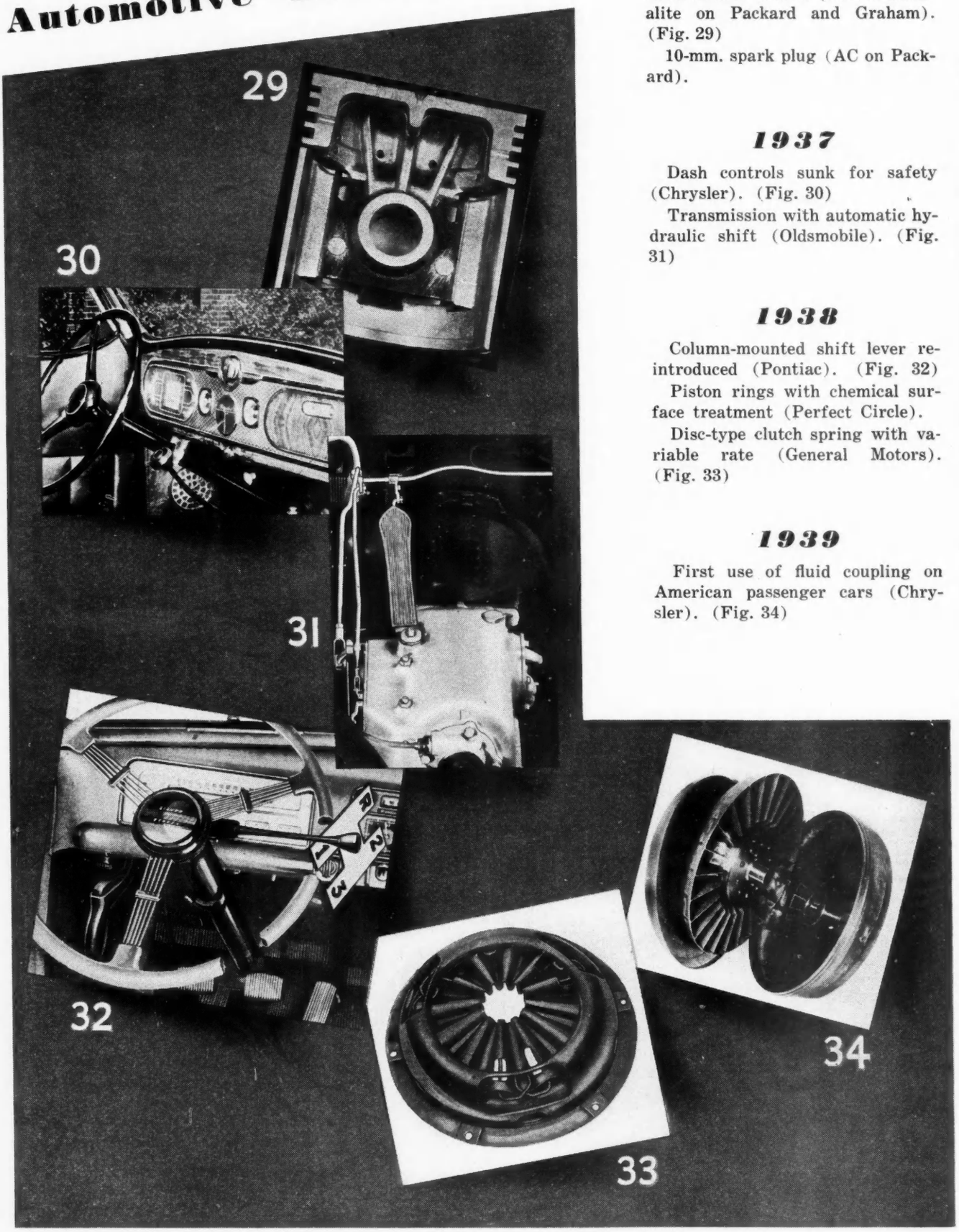
Unit construction of chassis and body (Scarab, Lincoln-Zephyr). (Fig. 27)

Thin-walled cast steel pistons (Ford). (Fig. 28)

First American rear-engined streamlined car (Scarab).

Hydraulic hillholder (Studebaker).

A DECADE of Automotive Development



1936

Stainless-steel exhaust valves (Chrysler and Graham).

Aluminum-alloy pistons with thermostatic control (Nelson-Bohnalite on Packard and Graham). (Fig. 29)

10-mm. spark plug (AC on Packard).

1937

Dash controls sunk for safety (Chrysler). (Fig. 30)

Transmission with automatic hydraulic shift (Oldsmobile). (Fig. 31)

1938

Column-mounted shift lever reintroduced (Pontiac). (Fig. 32)

Piston rings with chemical surface treatment (Perfect Circle).

Disc-type clutch spring with variable rate (General Motors). (Fig. 33)

1939

First use of fluid coupling on American passenger cars (Chrysler). (Fig. 34)

AUTOMOTIVE INDUSTRIES *Just among Ourselves*

THE wake of recent strikes in the Detroit area finds the city equipped with a "Detroit Council for Industrial Peace." The directors are representative business and professional men, with a sprinkling of the cloth. A good many companies dependent upon automobile manufacturing for their chief source of business are represented, but the name of a single automobile manufacturing executive doesn't appear on the list of directors.

Undoubtedly, this does not represent lack of sympathy with the objectives of the Council, which has been publishing in the Detroit newspapers advertisements directed toward enlisting the largest possible section of the public on the side of moderation, arbitration and conciliation, as opposed to strikes and violence in labor disputes.

Readers of the advertisements are asked to fill in coupons expressing their agreement with the platform laid down by the Council. According to the Council's management, thousands of these coupons have been filled out and mailed to headquarters. If the Council keeps its nose clean, it may become a considerable power in the industrial life of Detroit, and its subsequent action may do the automobile industry a lot of good.

Particularly from Washington, the automobile manufacturing industry has been damned both for its sins of omission and commission. Consequently, it has fought shy of cooperative solution for labor ills. Strikes have been met by sturdy, independent action by the management involved. The Automobile Manufacturers Association does not have a Labor Committee. When the Chrysler Corp. was strike beset, it was said in Detroit that Chrysler was fighting the industry's battle. It was said also during the big General Motors strike at Flint. And on the issue of the open shop, it was said of the Ford Motor Co. The industry may be said to have a solidarity of interest which gives any of its member companies a consciousness of destiny when there's a battle of principle to be fought. But the battles themselves are fought alone by the organizations where trouble has occurred. Otherwise, the road would be lined with caluminators willing to cast the first stone tagged "trust" or "monopoly."

We Exploit Machines . . . . Not Men

At the forty-fourth Congress of American Industry held in New York early in December, Paul Garrett, director of public relations of the General Motors Corp., delivered a rather remarkable address on "Propaganda for Democracy:" The definite text, in pamphlet form has just arrived, and loses nothing of its vigor for a second reading a month after delivery.

Summarizing the accomplishments of American industry under the American system, Mr. Garrett creates a phrase which I believe will be repeated widely. He says: "In our economy . . . we exploit machines—not men."

And because of this?

"Very nearly every home luxury is known the world over as an American creation. America is rich in its possession of all the little things any family wants. We represent only 6 per cent of the world's area and only 7 per cent of its people. But, and for that let us be humbly thankful, we own, use and enjoy 70 per cent of the world's automobiles. More than half of the world's radios; 60 per cent of the world's telephones. Most of its refrigerators. Bathrooms, too. Schools enough for every child. Power and light widespread and plentiful. Looking to future protection of our families, 70 per cent of the world's life insurance. And we have enough good movies to entertain the nation with a new show every night."

Mr. Garrett is right. Those are the things which interest the average American. Those are things, no matter what you may think of them as final measures of accomplishment, which would make the average American sore for the doing without. And we have got them by exploiting the machine, as it has never been exploited anywhere in the world.

If you want to know the rest of the story, write the Public Relations Department, General Motors Corp., New York, for a copy of Garrett's speech. The title—again— is "Propaganda for Democracy."

"Home Made"

Every mail brings evidence that the war in Europe has caused British colonies and dominions overseas to give a thought to home manufacturing of goods—particularly automotive—now difficult to obtain from foreign sources.

Largest item in an impressive list is the decision of the (Australian) Consolidated Industries, Ltd., to form a company capitalized at £1,500,000 to make automobiles in the Commonwealth. One of the directors of the company is in New York now with a view to purchasing a complete plant or equipment for one, and another of the directors sailed from Sydney on Jan. 6 with the same project in view.

—HERBERT HOSKING.

Suggested Modifications in Gear

By P. M. HELDT

SINCE the article under the above heading appeared, in the Oct. 15 issue of AUTOMOTIVE INDUSTRIES, a number of letters have been received on the subject from men more or less intimately connected with gear design and gear calculations. The author wishes to thank the writers of these letters for their comments and criticisms, which have led him to look up some of the references given and to make a further study of the problem. The letters referred to are appended to this article. (See pages 59 to 62.)

When the tooth pressure or the force acting along the line of action is resolved into parallel and perpendicular components at the point of contact, the perpendicular component evidently must be considered as a concentrated force which passes through the weakest section of the tooth (in most cases at least) close to one edge. It is now clear to the writer that in assuming the resulting compressive stress at the adjacent edge of the weakest section to be equal to the stress which would be caused if an equal compressive force were distributed over the entire section, the former was greatly underestimated. There is an obvious advantage in resolving the tooth pressure at the center line of the tooth. As explained in some of the accompanying letters, this procedure is entirely logical, since a force acting along a certain line may be considered to be acting at any point of that line. It is also justified by the theorem of theoretical mechanics that a given force is equivalent in its effects (and therefore can be replaced by) the combination of an equal force acting along a line parallel with the former and a moment equal to the product of the force by the distance between the two lines of action. If the tooth pressure is resolved at the center line of the tooth instead of at the tooth surface, the moment arm of the parallel component is, of course, reduced, but, as shown by Mr. Huebotter, the moment which must be added when transferring the perpendicular component from the tooth surface to the tooth center line exactly makes up for the shortening of the moment arm of the parallel component.

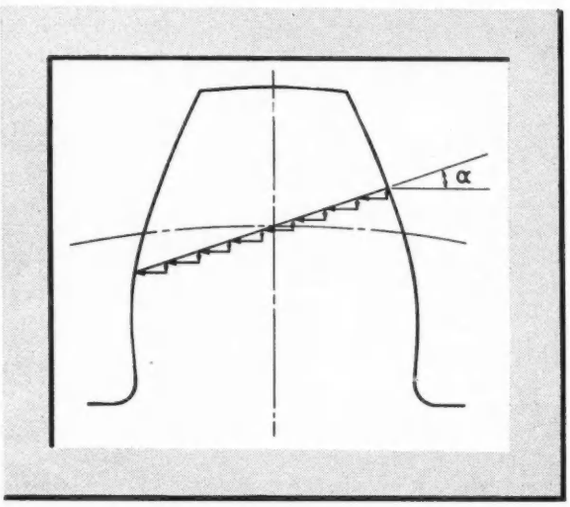


Fig. 1—Illustrating that when tooth pressure is resolved at the tooth center the perpendicular component may be considered a distributed force

Another advantage in resolving the tooth pressure into parallel and perpendicular components at the tooth center line is that in that case the perpendicular component may be considered a distributed force. Since the tooth-pressure force may be assumed to act on the tooth at any point of the line of action within the tooth profile, obviously any fraction of this force may be considered to act at some particular point along this line, and we may, therefore, consider the entire force distributed along the line and the perpendicular component distributed over the thickness of the tooth, as indicated in Fig. 1. With the perpendicular component thus distributed, it is easy to see that the compressive stress due to it is substantially equally distributed over the weakest section, and the resulting stress at the tooth faces then can be easily found.

These changes in the method described in the preceding article do not necessitate a change in the equation for the tooth-form factor z, viz.

$$z = \frac{4 \times l r_1}{p r (6 l - t \tan a)},$$

but since x, l and r_1 have different values when the tooth-pressure is resolved at the center than when it is resolved at the contact surface, z also will have a different value. Another problem arises here. The stress arrived at by inserting the values of z thus found in the equation

$$S = \frac{F}{w p z} \text{ lb. per sq. in.}$$

where F is the tangential force on the pitch circle, w

Teeth Formula

the face width of the gear, and p the circular pitch, is the stress on the pressure side of the tooth where the material is in tension. The greatest stress actually occurs on the opposite side, where the material is in compression. This is due to the fact that as shown at *A* in Fig. 2 the parallel component creates stresses in the weakest section which vary from a certain tensile stress on the pressure side, through zero at the center line, to an equal compressive stress on the trailing side of the tooth; and on these stresses are superposed uniform compressive stresses due to the perpendicular component, as shown at *B*, so that the total stresses in the weakest section are distributed as shown at *C*.

Just what maximum load the tooth will be able to carry safely therefore may depend on either the tensile strength or the compressive strength of the material. In the case of cast iron gears, there is no question that tooth breakage would result from the tensile strength of the material being exceeded, because cast iron has a compressive strength several times its tensile strength, and the compression stress in the weakest section on the trailing side of the tooth never exceeds the tensile stress on the pressure side by more than about 25 per cent. In the case of steel, however, the tensile and compressive strengths are more nearly alike. There is, unfortunately, a great dearth of data regarding the compressive properties of materials of construction. Even in the case of bearing materials, which are always working under compression and never under tension, the tensile rather than the compressive strength is usually given. The National Bureau of Standards informed the writer that compression-strength tests of metals are rarely made because the results are somewhat arbitrary, depending upon the criterion of failure used.

It has always been the writer's opinion that breakage of the teeth of steel gears, such as those used in automobile transmissions and final drives, occurred under tension. Such failures usually are of the fatigue type; that is, an exceptionally severe shock produces a small crack that starts the fracture, which is extended slightly at every succeeding heavy shock, and an examination of the fracture after the tooth has broken usually clearly shows the progress of the failure.

In looking up the series of articles by Dr. E. H. Merritt in *The Engineer*, I found that Doctor Merritt in deriving his values for the tooth-form factor assumed the full load to be taken by the tooth at the point where contact occurs when the next tooth comes into action, and he also takes account of the vertical component of the tooth pressure. He, however, adds the stress caused in the weakest section by the perpendicular component to that caused by the parallel component. This would be correct if the tooth failed by crushing of the material or as a result of excessive compression. If failure is due to excessive tension, then, evidently, the stress due to the perpendicular component of the tooth pressure should be deducted from that due to the parallel component, since the perpendicular component produces compression over the whole or the weakest section, and on the loaded side of the tooth, where the parallel component produces tension, the compressive stress due to the perpendicular component neutralizes some of the tensile stress.

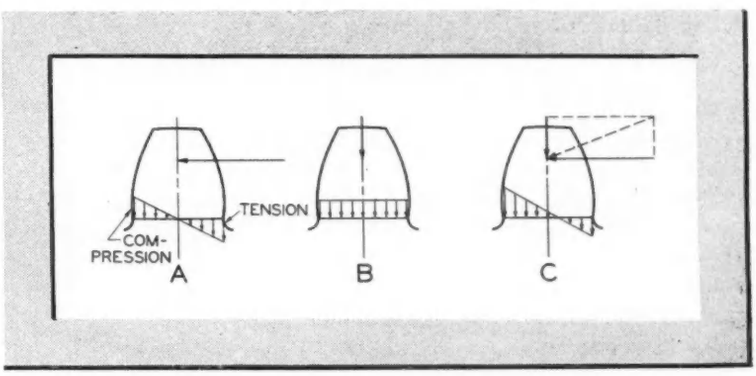


Fig. 2—Distribution of stresses in weakest section due to parallel component, perpendicular component, and both combined

In order to get either confirmation or refutation of my view that tooth breakage in hardened or heat-treated steel gears always starts on the loaded side of the tooth, I wrote to General Motors Research Division, which has carried out extensive endurance tests on final-drive gears, and to S. O. White, vice-president of engineering of Warner-Gear Division of Borg Warner Corporation, who has had perhaps as wide an experience with automotive gears as any one in this country.

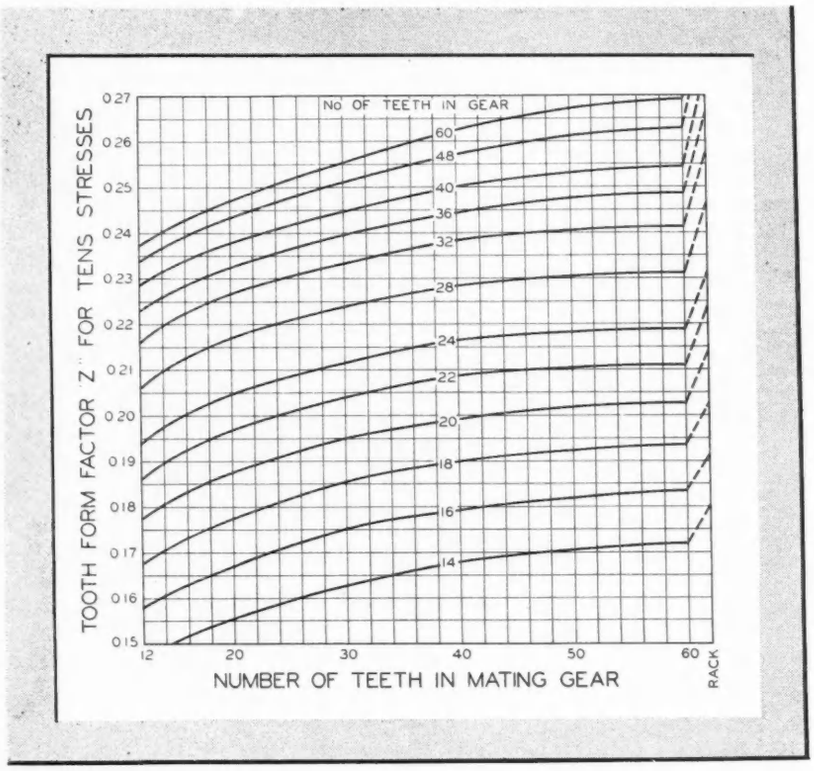


Fig. 3—Chart of tooth-form factors for American-Standard stub-tooth gears

John C. Straub of General Motors Research Laboratories Division, wrote that "the centers of the concentric circles of progressive fatigue failure are always on the driving side of the tooth, rather than on the trailing side. This is true in spiral bevel gears as well as in helical gears." This, of course, shows that failure starts on the driving side and, therefore, occurs under tension.

Mr. White wrote as follows:

"From time to time we run dynamometer tests here on transmission sets, carrying the tests to failure. When it is a gear failure, usually one or two teeth break out, these folding over, so to speak, in the compression direction; that is, away from the drive. There are then usually a few other teeth that are slightly bent.

"On examining these gears under glass, after they have been etched, there are always fine checks or cracks that show up at the base of other teeth, showing that failure is starting. These cracks are always found on the tension side of the teeth. This applies equally to gears from case-hardening steel and oil-hardening steel.

"The result seems to be the same also regardless of whether the breakage has occurred from overload or from fatigue due to a long and continuous run."

The foregoing seems to warrant the conclusion that when tooth failure in a case-hardened or oil-hardened gear occurs it is due to the fact that the tensile stress at the edge of the weakest section on the loaded side of the tooth has exceeded the endurance strength of the material in tension. As the actual tensile stress along this edge is equal to the difference between the tensile stress which would be produced there by the parallel component of the tooth pressure if it acted alone, and the compressive stress which would be produced by the perpendicular component if it acted alone, the tooth-form factor should be based on the difference between these two stresses, that is, on the effective stress. Fig. 3 is a chart of tooth-form factors arrived at on this basis.

Mr. Huebotter has raised the point that the stress concentration due to the more or less abrupt change in section at the root of the tooth should be taken into account. This stress concentration was investigated by the photo-elastic method by Timoshenko and Baud at the Westinghouse Laboratories in 1926, and their results are given in Fig. 4, in which the stress-concentration factor is plotted against the ratio r/t (fillet radius divided by thickness of tooth at weakest section). In American Standard stub-tooth gears with 20-deg. pressure angle the minimum fillet radius is $0.2/p$, where p is the diametral pitch. This minimum fillet radius is still generally used, although hobs of the round-nose type, which give a larger fillet radius, are now available. We may designate the stress-concentration factor, that is, the stress by which the stress at the edge of the weakest section is multiplied as a result of stress concentration due to the change in section, by q. With the minimum fillet radius for American Standard stub-tooth gears the ratio r/l varies from 0.125 for 12, to 0.100 for 60 teeth, and according to Fig. 4 the value of q varies correspondingly from 2.02 for 12 teeth to 2.19 for 60 teeth. In Fig. 5 are plotted curves of the quotient z/q for American Standard stub-tooth gears with different numbers of teeth when meshing with gears of different numbers of teeth. The values

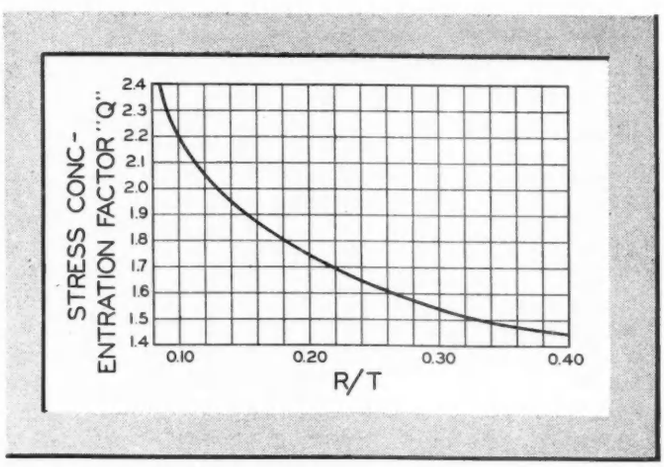


Fig. 4—Stress-concentration factors for the roots of gear teeth according to Timoshenko and Baud

of z/q can be substituted in the Lewis gear-strength formula for the tooth-form factor y and then give what the writer considers the most rational formula for the beam strength of gear teeth:

$$F = S\ p\ w\ \frac{z}{q}\ \text{lb.},$$

where F is the permissible tangential force on the pitch circle; p, the circular pitch in inches; w, the face width in inches; z, the tooth-form-factor determined as outlined in the foregoing, and q, the stress-concentration factor based on the Timoshenko and Baud results. Values of z/q can be read off directly from Fig. 5.

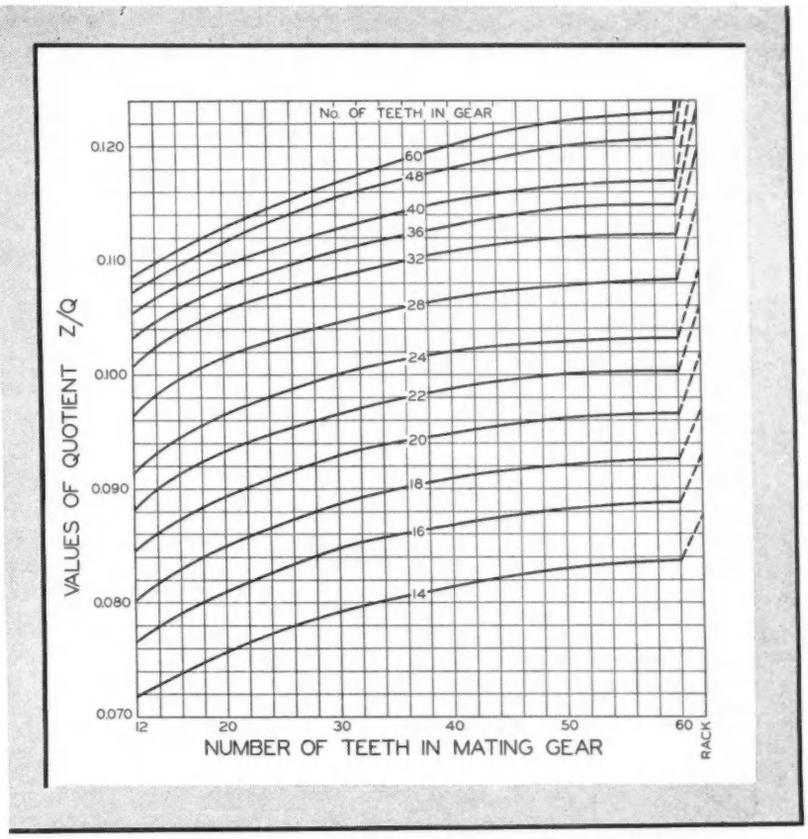


Fig. 5—Chart of ratio z/q for American-Standard stub-tooth gears

It is often stated that the Lewis formula errs on the side of safety by assuming the full tooth load to be taken at the tip of the tooth. By neglecting the stress concentration due to the rapid change in section at the root, it actually errs in the opposite direction. When using the Lewis formula the effect of stress concentration had to be allowed for by using low nominal stresses. The actual load-capacity of a tooth, of course, is independent of the method by which it is calculated, and since z/q is always less than the Lewis tooth-form factor y, higher nominal stresses can be used when using the above than when using the Lewis formula.

Discusses Load Application . . .

Editor, AUTOMOTIVE INDUSTRIES:

In the Oct. 15, 1939, issue of AUTOMOTIVE INDUSTRIES, P. M. Heldt presented some most interesting and thought-provoking ideas in his article "Suggested Modifications in Gear Teeth Formula." Most of us who have had anything to do with gear-tooth design have speculated at some time or other on the possibility of bringing the Lewis' formula around to yield results that approach more nearly the actual stress conditions in an operating gear tooth.

In studying very carefully Mr. Heldt's analysis of this problem it becomes evident that some refinements in the Lewis formula are possible and perhaps advisable. For instance, his demonstration of the fact that the maximum load on a single tooth in contact is carried not on the corner of the tooth but at some determinable point below the tip is convincing indeed and might well be applied to modify present practice. His next proposal, however, is less convincing.

The gear tooth force is resolved into two components at the tooth surface as in Fig. 1 of the article, one parallel to the root section and the other perpendicular to that section. The former, the author states, induces bending stresses in the tooth and the latter induces only direct compression. Notice, however, that the latter, called the "perpendicular component," is offset from the neutral axis of the tooth and, as a result, produces not only direct compression in the tooth, but bending as well. The bending produced by this "perpendicular component" is a result that is bound to arise if one resolves the tooth pressure into its components at the driving face of the tooth. This is the answer to Mr. Heldt's question concerning the reason for applying the force, as is done in Lewis' derivation, "at the point where the line of action intersects the radial center line of the tooth." It is only by applying and resolving it there that the eccentric bending effect of the "perpendicular component" is eliminated.

This question now comes to mind. If the author has developed his method of analysis with the object of refining present procedure, how does he justify neglecting any factor that may affect the stress distribution—especially one as influential in this respect as the bending moment just discussed seems to be?

Furthermore, in his refined analysis, does Mr. Heldt give any consideration to stress concentration in the root filet? The Lewis formula, it is true, is conservative but is usually accepted as such to furnish an additional safety factor for uncertain concentrations of

stress. It is possible, of course, that it allows a greater factor than is necessary, since the author's mention of General Motors test results shows that even though his formula was less conservative than Lewis' it still proved to be safe when compared to actual endurance data.

Although this discussion shows a disagreement with one of Mr. Heldt's major assumptions it must be granted and emphasized that the latter has made a contribution to the art of gear design that should be given the most thoughtful consideration. His method of determining exactly the nature of tooth contact and its effect on the location of the load application and on the form factor constitutes definite refinements in present gear design practice.

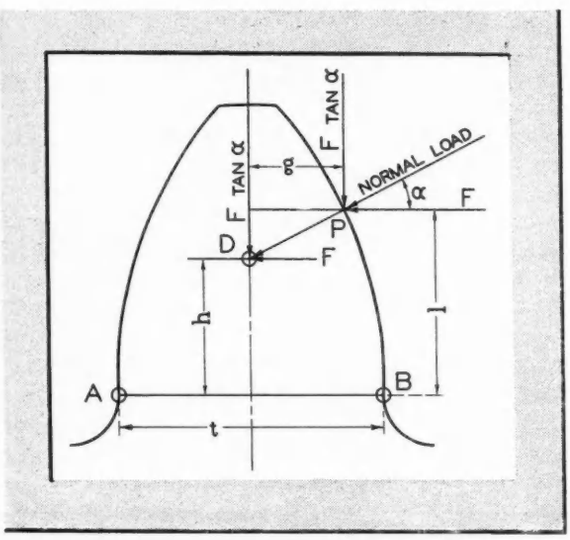
H. A. BOLZ,
Instructor in Mechanical Engineering,
Purdue University.

Added Component Suggested . . .

Editor, AUTOMOTIVE INDUSTRIES:

I have read with great interest the article by P. M. Heldt in AUTOMOTIVE INDUSTRIES for Oct. 15, 1939, p. 428, entitled "Suggested Modifications in Gear Teeth Formula"; particularly as the proposed method closely resembles that proposed by Dr. H. E. Merritt, and which has been employed in these works for some years. (See H. E. Merritt, "The Technique of Gear Design," Proc. I.A.E., Vol. XXII, p. 86; and a very full treatment in *The Engineer,* London, July, 8, 1938, p. 32, "Gear Performance—II. The Strength of Gear Teeth.")

The only material difference between the treatments of Heldt and Merritt is that the former insists that the normal tooth load must be resolved into tangential and radial components where the line of action intersects the tooth profile, instead of where it intersects the radial center line of the tooth. I venture to suggest that he is in error in thinking that this makes any difference to the result. He appears to have overlooked that since "the perpendicular component, which is equal to $F \tan \alpha$, passes through the root section not far from the pressure side of the tooth," it not only "tends to cause compression" in this section, but also, by virtue of its eccentricity, exerts a bending moment on this section opposed in sense to that exerted by the tangential component. In the attached figure, therefore:



Sketch accompanying Mr. McEwen's letter.

1. Resolving at D, the intersection of the line of action with the radial tooth center line, the root section AB is subjected to:

a. A bending moment	$F.h$
b. A compressive force	$F.\tan\alpha$

2. Resolving at P, the intersection of the line of action with the tooth profile, the root section AB is subjected to:

a. A bending moment	$F.l$
b. A bending moment	$-F.g.\tan\alpha$
c. A compressive force	$F.\tan\alpha$

But $l = h + g.\tan\alpha$
Hence the net bending moment

$$= F.l - F.g.\tan\alpha$$
$$= F.(h + g.\tan\alpha) - F.g.\tan\alpha$$
$$= F.h$$

which is the same result as was obtained in (1) by resolving at D.

Again, the maximum stress at any point is not at B on the pressure side, but at A. At B the actual stress is tensile and equal to

$$S_B = \frac{6F.h}{w.t^2} - \frac{F.\tan\alpha}{w.t} = \frac{F}{w.t^2}(6h - t.\tan\alpha)$$

whilst the actual stress at A is compressive and equal to

$$S_A = \frac{6F.h}{w.t^2} + \frac{F.\tan\alpha}{w.t} = \frac{F}{w.t^2}(6h + t.\tan\alpha)$$

The tooth form factors Y, which appear in the Draft Revision of British Specification 436, Helical & Straight Spur Gears, and also those published by Doctor Merritt, in the series of articles in *The Engineer,* already referred to, are based on this last equation. It is to be noted that these are based on unit diametral pitch, and the recommended correction systems. It is necessary, therefore, in comparing actual values to introduce π.

EWEN MCEWEN, *B.Sc.* (Eng.)
Research Engineer, David Brown & Sons, Ltd.,
Huddersfield, England.

Determination Amplified . . .

Editor, AUTOMOTIVE INDUSTRIES:

Please permit me to offer a suggestion or two regarding the method of estimating stress in gear teeth, described in your article in AUTOMOTIVE INDUSTRIES, Oct. 15, 1939.

In this method you include the compressive stress produced by the "perpendicular" or radial force component $F \tan \alpha$, which was ignored by Lewis; but you, in turn, omit the bending moment due to the eccentric position of this component. Let the eccentricity at the point of contact be e. The corresponding bending moment is $-Fe \tan \alpha$. The total bending moment then becomes $Fl - Fe \tan \alpha = F\ (l - e \tan \alpha)$. The stress produced by combined bending and compression becomes

$$S = F\ [6(l - e \tan \alpha)/t - \tan \alpha]/wt.$$

I feel sure that you will agree that this improves the accuracy of the determination.

Next let us consider the stresses obtained by working at the point of intersection of the line of force and the tooth center line. The tangential component is F as before. Its moment arm is now $(l - e \tan \alpha)$, and the resulting bending moment is $F(l - e \tan \alpha)$, just the same as above. That is, when the whole effect of the oblique force is considered, we get the same result at the point of contact and at the intersection on the center line. This, of course, is consistent with an elementary principle of mechanics, that a force may be considered as being applied at any point in its line of direction, without altering its effect.

The method of calculating combined stresses with the force components taken at the point of contact, was used in Bulletin No. 288, Engineering Experiment Station, University of Illinois: "An Investigation of Relative Stresses in Solid Spur Gears by the Photoelectric Method," by Paul H. Black. I prefer the method with the force components taken at the point of intersection on the tooth center line, because it seems to be shorter and simpler.

Since the total bending moment can be correctly determined by taking the tangential load component at the point of intersection with the tooth center line, a parabola with vertex at this point represents a beam of constant maximum stress of the same value as the maximum *bending* stress in the tooth, namely, the bending stress in the weakest section.

Regarding the actual distribution of stress across the weakest section, in addition to Bulletin No. 288, see, for instance, "The Strength of Gear Teeth," by Timoshenko and Baud, *Mechanical Engineering*, Vol 48, No. 11, (November, 1926), page 1105.

If you come to agree with these suggestions for improving the accuracy of this determination, you may wish to publish a revision of your method.

A. H. CANDEE,
Gleason Works.

Another Route . . .

Editor, AUTOMOTIVE INDUSTRIES:

P. M. Heldt's article on "Suggested Modifications in Gear Teeth Formula" seems to invite discussion. In order to avoid confusion, I am going to retain Mr. Heldt's terminology and notation.

I agree with Mr. Heldt sincerely that gear-tooth form factors need revision, but I should base the change on different principles from those analyzed in his article. I cannot concur with Mr. Heldt's method of computing the bending moment acting on the weakest section. He prefers to resolve the load into the parallel and perpendicular components F and $F \tan \alpha$ (Fig. 2 of the article) at the contact point. The resolution may be effected anywhere he chooses, provided the moments about the neutral axis of the weakest section are all retained.

In my Fig. 5 I have let m represent half the chordal thickness of the tooth at the point of load application. Then the moment of the tooth load with respect to the neutral axis, being the algebraic sum of the moments of its components, is equal to $F\ l - m\ F \tan \alpha$ or to $F\ (l - m \tan \alpha)$. If we resolve the load into components at the centerline of the booth, the perpendicular component has no moment arm, and the parallel component F has the arm $l - m \tan \alpha$ so the moment at the axis of the section is independent of the point of resolution. Hence the choice of the tooth centerline for resolving the load is dictated by convenience, and is not an assumption as Mr. Heldt implies.

I am going to mention three different tooth form factors, identifying them by the names of their originators.

The Lewis form factor, as Mr. Heldt remarks, is conservative when applied to precision gears. It is, however, a fairly reliable criterion of helical transmission gear durability when applied in a certain way, as pointed out by Messrs. Almen and Straub of the General Motors Research Laboratories.

The Gleason form factor, discussed by Messrs. McMullen and Durkan of the Gleason Works in *Machinery*, June and November, 1922, was demonstrated by Almen and Straub to be valuable in spiral bevel rear-axle gear analysis.

The Heldt form factor proposed in the article under discussion recognizes the principle on which the Gleason form factor was derived but has a value that lies somewhere between the Lewis and the Gleason form factors. My criticism of all of them is that they neglect the stress concentration at the base of the tooth caused by the sudden change in section. They fail to recognize the benefits in gear-tooth life that should accrue from the more liberal root fillet obtainable by the use of round-nosed hobs. For example, the tooth profile in Fig. 5, which was generated by a sharp-cornered hob, should have the stress boosted at least 80 per cent above that computed in plain flexure, caused by

the insignificant fillet. A gear of the same tooth system with a larger number of teeth would have a still smaller fillet. A round-nosed hob should generate a fillet that would cause a stress increase of not more than 50 per cent.

Mr. Heldt speaks of the conservatism of the Lewis form factor. As a matter of fact, the tabulated values are somewhat optimistic in the small tooth-numbers, but the error diminishes as the number of teeth increases. For example, the official Lewis form factor for a 15-tooth 20-deg. generated involute A.G.M.A. stub-toothed pinion is 0.111. Both graphical and analytical determinations of the Lewis form factor for the tooth in Fig. 5 give 0.1050 ± 0.0003.

A quick checkup on Mr. Heldt's data gives the following results, to which are added the Gleason form factors:

Form Factor	Tooth Number	Analytical	Graphical
Heldt	15–15	0.1135	0.1128
Heldt	15–60	0.1280	0.1280
Z	15–15	0.132	
Z	15–60	0.145	
Gleason	15–15	0.1412	0.1402
Gleason	15–60	0.1618	0.1623
Lewis	15	0.1053	0.1047

H. A. HUEBOTTER.

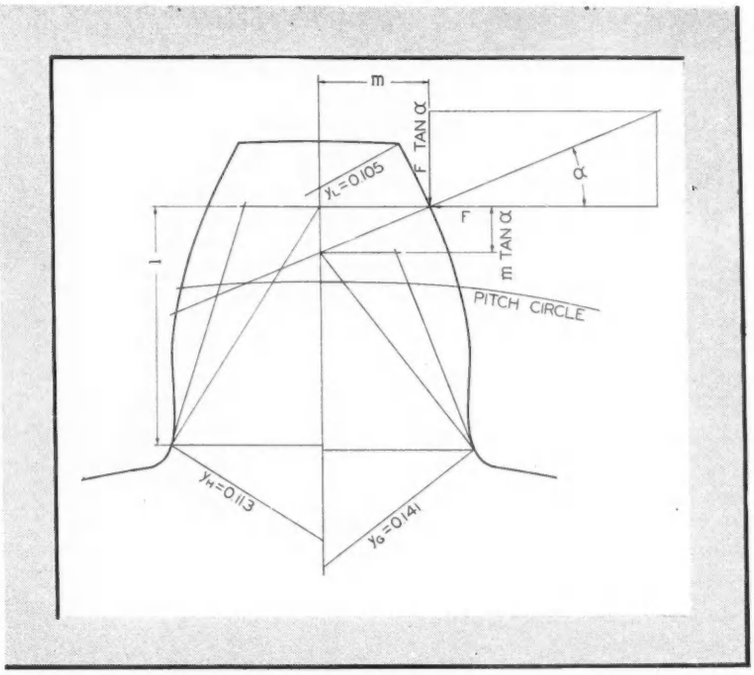


Fig. 5—Components of Tooth Pressure.

Automotive Leaders' Outlook is Optimistic for 1940 Business

MOST forecasts of business in 1940 seem hopefully optimistic, but nearly all are tinged with a note of caution. A majority of the prognosticators appear to feel that slower operations may be expected in the first quarter of the year with another upward spurt in the second quarter.

A survey among one hundred top executives of leading manufacturing enterprises, made by Briggs, Mohrman & Co., New York Stock Exchange members, revealed that these men do not share the pessimism over the immediate future circulated recently by some economists. However, misgivings over the longer term outlook were frequently expressed.

Consensus of automotive manufacturers included in the survey was that, on the basis of historical pattern, 1940 automobile sales should be at a higher level than 1939. The low level of outstanding instalment paper aids the situation. An increase over the current rate was reported as possible, as the car builders are endeavoring to carry slightly higher field stocks because of the labor situation. Foreign demand is bolstering truck sales and plants are expected to continue close to capacity. Sales of original equipment tires were expected to be satisfactory, but replacement demand was expected to be less than in 1939.

Manufacturers of steel products, questioned in the survey, appear to feel less doubt about the second quarter than the steel producers. Because of the dilapidated condition of much industrial equipment, it is felt that a high level of business would support current volume for some time. The machine tool industry is booked solidly for the first half of 1940.

Excerpts from statements made to the press by a few of the leaders in the automotive industry follow:

Alfred P. Sloan, Jr., chairman of General Motors Corp.—"It is manifestly impossible (to forecast what is in store for us) today with the world in such a state of economic and political disorder, bordering even on international chaos. As I see it, we must stand by, ready to adjust our thinking and prepared to act intelligently as the changing circumstances unfold themselves. . . . Our own domestic situation, to say nothing of the world situation, demands that we put our house in order."

William S. Knudsen, president, General Motors Corp.—"We certainly can look forward to good business in 1940, which, if the present trend continues, is reasonably sure to show an increase over the 3,700,000 car total for the industry obtained in 1939."

James S. Knowlson, chairman and president, Stewart-Warner Corp.—"Certainly the present level

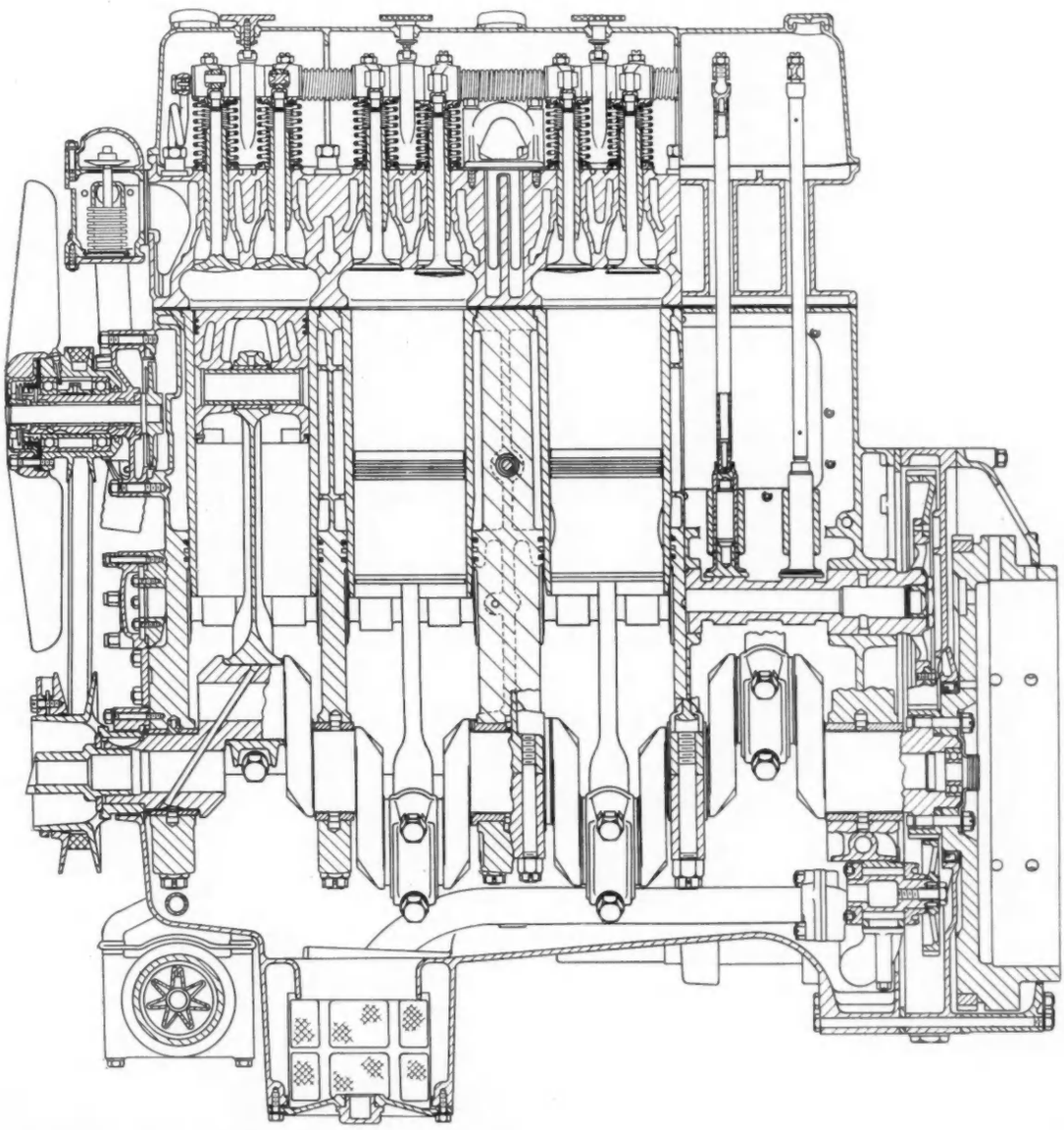
(*Turn to page* 87, *please*)

DENNIS BIG FOUR TRUCK ENGINE

Longitudinal Section

Used in a four-wheeled truck chassis with a load capacity of 6 to 8 long tons and a gross weight of 12 tons, the Dennis Big Four gasoline engine is an optional power unit made by the Dennis Bros., Ltd., Guilford, England, the alternative being a diesel engine of somewhat smaller piston displacement.

With a bore and stroke of 120 x 150 m.m. (approximately 4¾ x 5⅞ in.), giving a piston displacement of 6,780 c.c. (293.6 cu. in.), the power output at 2,000 r.p.m. is 100 b.h.p. Maximum torque is 290 lb.-ft. at 900-1,300 r.p.m. and b.m.e.p. 118 lb. per sq. in. at 1,000 r.p.m. The compression ratio is 5.25 to 1. Valves in



DENNIS BIG FOUR TRUCK ENGINE

Transverse Section

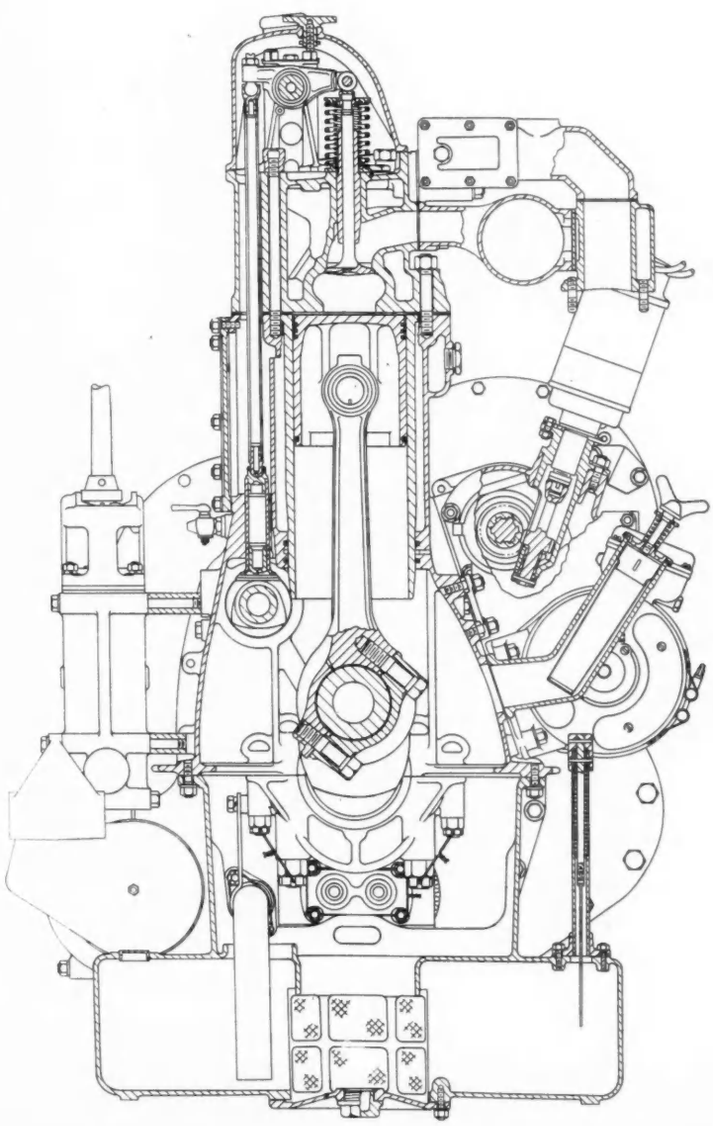
the head are pushrod operated and are set vertically in line-ahead in an oval-shaped combustion chamber with a major diameter of 6 in and minor diameter of 3 in. and a neck narrowing to 5 in. and 2¼ in. respectively above the cylinder bore. Inlet valves are of 1⅞-in. effective diameter, and exhausts 2-in. Although valve seats are integral in the cast-iron head and are standard, provision is made in the casting for fitting renewable seats, either originally or as a reconditioning process.

The cylinders have cast-iron wet liners with a three-ring gland water seal at the bottom end and flanged top end sealed by the head gasket. Pistons are of aluminum with three pressure rings in the crown and a scraper in the skirt. The steel connecting rods, with floating wrist pins, have their big-ends split at an angle of 50 degrees from the vertical, the caps being held by threaded studs in place of bolts; this arrangement has been adopted to permit the withdrawal of the piston and rod assembly up through the cylinder bore if desired.

The five-bearing hollow crankshaft is hardened and has journals of 3⅜-in. diameter and 3⅛-in. pins. Total journal bearing area is 36.87 sq. in. Bearings are all white-metal lined. Distribution gear is at the rear end, where a pinion meshing with the crankshaft gear gives direct drive to the oil pump, which has an intake pipe of 1½ in. diameter leading to the interior of a cylindrical gauze filter in the sump at the front end. Adjacent is an external by-pass pressure filter serving also as an oil cooler. The oil capacity is 4½ gallons. Pressure is carried to the crankshaft and big-end bearings, camshaft, overhead assembly and auxiliary drives.

Ignition is by battery-coil with centrifugal and vacuum timing control; the latter combination is unusual in British truck practice. A horizontal carburetor is fitted with mechanical pump feed. Water circulation is by impeller type water pump, belt-driven in tandem with the fan. Special water passages and deflectors occur in the cylinder head to direct water to the valve seats. The weight of the engine with flywheel is 1,358 lb.

A noteworthy feature of the design is the heavy trussed bearing caps.



PRODUCTION LINES....

Steel Cutting

For the first time since the introduction of Carboloy its producers have issued an engineering bulletin on the subject of machining steel. It contains full details on tool design, tool form, coolant, chip breaking, the machine itself. In addition, it has two tables giving recommended speeds, feeds, depth of cut, for a variety of commonly used steels. And, finally, there is a table giving the Carboloy grades commonly used for steel cutting. By all means ask us for a copy right away. It's hot!

New Bearing

In a few months you will be treated to the details of a new engine bearing that seems to answer the requirements of the ideal. It is absorbingly interesting as to properties, metallurgical character, and manufacturing details.

Long Lived

Interesting application of Neoprene is its use in a unique airplane brake, at the moment a commercial secret. In this brake, a flat inner tube of Neoprene is inflated upon brake application, forcing segmental blocks of brake lining outward. The application emphasizes some of the amazing properties of this rubber-replacing material—principally its flexibility and elasticity, great load-carrying capacity, resistance to oil and moisture and ageing.

Cutting Steel

For the first time since the introduction of Carboloy, its producers have issued an engineering bulletin on the subject of machining steel. What interests us most is the fact that coolant is given an important place in the process with special instructions as to flow and application to the tool tip. Interesting it is to learn that soluble oil has proved superior to other coolants for this special application.

Proving Ground

Bendix has issued an instructive and interesting manual on the subject of Dynamometry intended to aid service stations in the proper use of the Bendix chassis dynamometer—the indoor proving ground, as they have happily named it. Incidentally, the content of the manual is really a liberal education on the subject of tune-up. As such it should be of more than passing interest to factory engineers concerned with the maintenance of equipment in the hands of owners.

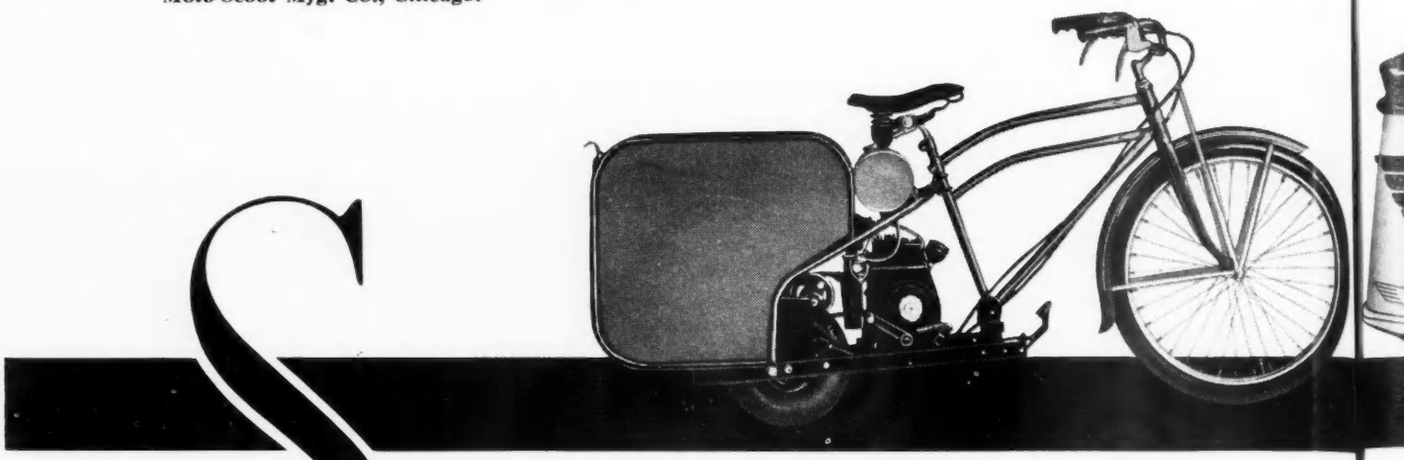
Private Show

Went visiting recently to the private machine tool show in the plant of the National Broach and Machine Co., where they displayed some striking equipment which was to have been shown in Cleveland. Most impressive was the Red Ring Rotomill in which milling cutters arranged for climb-cutting replace conventional turning. It handles a surprising variety of forms and sizes, the job on demonstration being a transmission clutch gear, finished in one setting right from the rough forging. Complementing this machine is the Rotoshaving machine whose function is to replace the grinding of parts by an application of special milling cutters. Noteworthy feature of all Red Ring equipment currently produced is the emphasis upon styling. Externally, each machine is tailored for eye-appeal and in the process its designers have effected many improvements and simplifications in controls and accessibility.

Automatic Units

This year all eyes are on automatic transmissions. Of more than passing interest in this connection is the educational film produced by Olds which describes succintly but comprehensively the basic features of the Hydra-Matic transmission. This is by far the most satisfactory way of explaining its operation, as those who have tried to do it by word of mouth can testify. Incidentally, we have learned privately that D. E. Banker, the inventor of the Mono-Drive automatic transmission has built some ingenious cut-away working models of his unit. It's scaled down in size but true to mechanical detail in every respect. It is portable, fitted with a small electric motor controlled by a sewing machine foot rheostat. This little gadget should be more fun than playing with your son's electric train.—J. G.

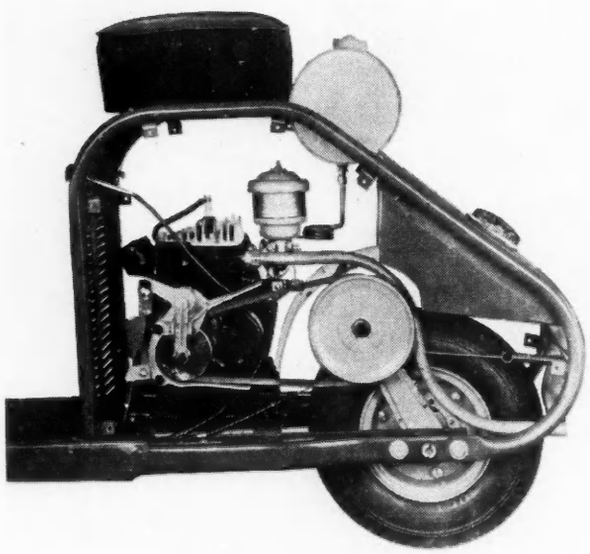
Here are shown, from left to right, the "Scooto-Bike" conversion unit (a moto-Scoot product) that can be applied to almost any bicycle; "Motor-Glide", a product of the Salsbury Corporation, Inglewood, Cal.; and the "Moto-Scoot", produced by Moto-Scoot Mfg. Co., Chicago.



SCOOTERS Open N

By HERBERT CHASE

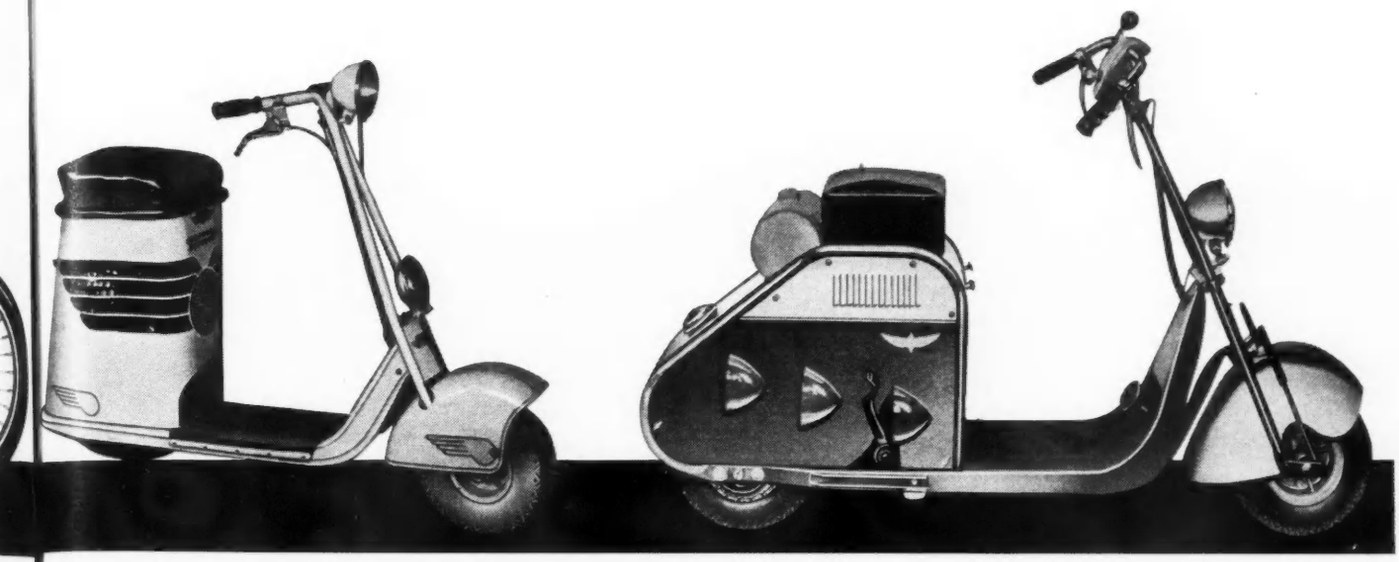
RELATIVELY new in the automotive picture, but growing rapidly, is the variant of the motorcycle, known as the motor scooter. It requires relatively little power and, as the maximum speed is usually well below 35 m.p.h. and the average much lower, miles per gallon of fuel are said to be in the neighborhood of 100. In general, retail prices range between $100 and $200, and since some machines, at least, are reported good for 35,000 miles or more, the scooter should afford a highly economical means of transportation. At least three companies are actively engaged in producing scooters, and the total output is such as to afford a market for automotive parts and materials which is not inconsiderable.



Rear portion of the Moto-Scoot "Century" model, equipped with a Briggs and Stratton 1½ h.p. engine, the primary drive being by V-belt.

Accompanying illustrations give a good idea of the general types of construction employed. Although construction resembles that of the bicycle in some respects, wheels are much smaller and, instead of the "diamond" or similar frame employed in the bicycle, there is substituted a low frame, usually built up from sheet-steel and rolled sections, but sometimes including tubular parts. The latter are used also for the forked members, joined to the frame by an inclined pivot and extended to support handle bars, much as in a bicycle but with the pivot much nearer the ground. At the rear the frame straddles the wheel, of course, and provides a bed for the engine, which is forward of and has its crankshaft axis at a higher level than that of the rear wheel.

Engines are all of the single-cylinder four-stroke cycle type and are made as light as is consistent with the low production cost necessary in a product of this kind. All engines are air cooled, of course, but are enclosed in sheet-steel housings, and provision is made for positive circulation of air to facilitate cooling. The framework for the engine housing is extended to support the seat, which is placed at a comfortable height so that the rider's feet can rest on the floor and, in some cases, operate a brake pedal. With this arrangement, the machine has a much lower center of gravity than a bicycle, both alone and in combination with the rider. This makes for safety and for convenience in mounting, dismounting and handling.

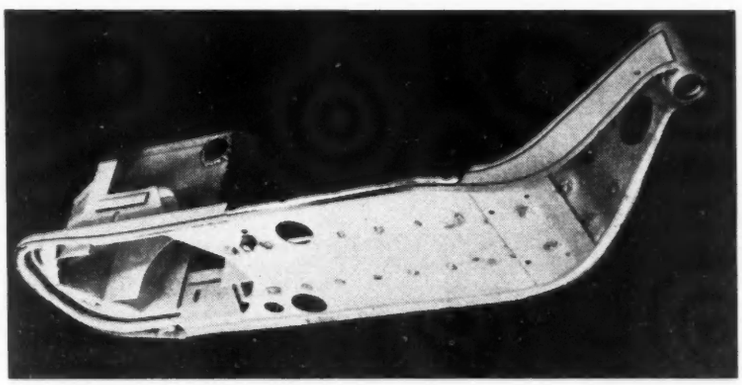


New Automotive Field

Makers provide outlets for parts that range from bearings and various other small products to complete engines

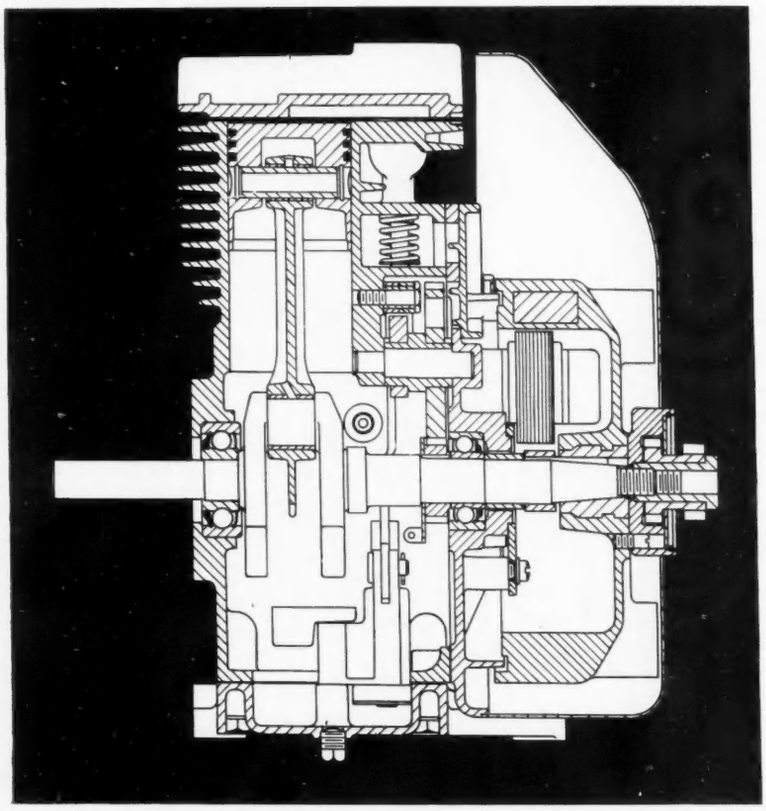
As engines turn at a fairly high speed so as to yield an adequate power output for a given weight, it is necessary, of course, to provide at least two reductions between the crankshaft and driving wheel. Some models have a two-speed gearbox with a lever to control shifting, but the majority have a belt in the primary drive (although some use a chain) and a roller chain in the second reduction. Models using a V-belt have adjustable sheaves so arranged that the effective diameter is varied by moving the flanges axially, giving a continuously variable reduction within certain limits (14:1 at start to 4:1 at 30 m.p.h. in *The Motor Glide*). This affords an inexpensive means of changing the reduction and also avoids the steps required in a positive drive.

There is, of course, a friction clutch between the engine and the drive, unless the belt is used as a clutch, so that the engine can idle when the vehicle is standing. In some cases a centrifugal device is provided to engage the clutch at a predetermined speed and disengage it when the speed falls below this level, thus avoiding the use of a pedal or hand control. A throttle control wire is extended to the handle bars, as in motorcycles, and on some machines a similar hand control operates the brakes. In other makes, the brake is pedal operated. Brakes bear on a rear wheel drum and are of the contracting type, some being servo types. Some makes have a spring suspension in conjunction with the front-wheel fork, but tires are the primary cushioning device front and rear. Cushion seats are also provided, some machines being for solo use and some for tandem riders.



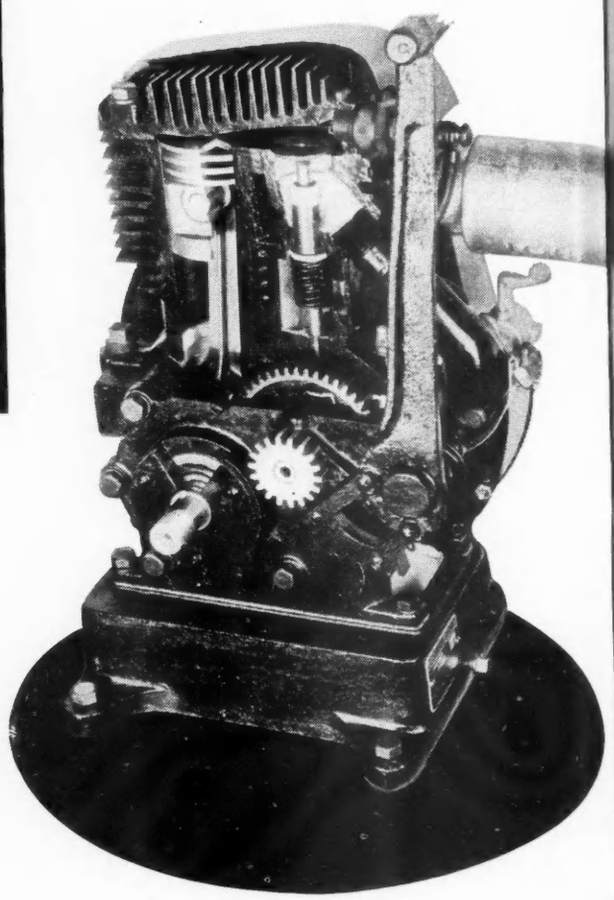
Frame assembly built up largely from pressed steel for the Salsbury "Motor-Glide".

Some models are available with package compartments, among them certain ones having an over-size compartment attached at the rear,



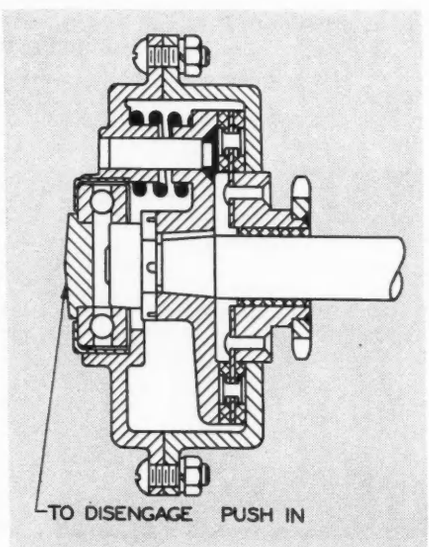
(Left) Sectional view of the Lauson engine (The Lauson Company, New Holstein, Wis.).

Below) Cutaway view of the Cushman engine (The Cushman Motor Works, Lincoln, Neb.).



as an eccessory, making the machine suitable for light package delivery. Side cars are also available, both for an extra passenger and for packages or other delivery service. Another alternative is a light trailer. Where the machine is to be used by garagemen in picking up and delivering cars, convenient towing attachments for the scooter can be had. Certain companies also offer modifications which include three wheels and an enclosure resembling in appearance a runabout body. In this case, a steering wheel is provided in place of handle bars. Wind screens attachable to conventional models are among common accessories, as are also generators and lighting equipment. Conversion units, to take the place of the rear wheel of an ordinary bicycle, are also offered.

It will thus be seen that manufacturers provide a considerable range of products to the jobbing and retail trade and are themselves purchasers of a large variety of automotive parts and units as well as of many types of materials. These range from complete power plants to bearings and other small parts and, on the materials side, include steel in many forms (such as sheet, bar stock, rolled sections, stampings, forgings, tube, etc.), sand castings and die castings, brake linings and clutch facings, finishes, plastic products and various non-metallic products.



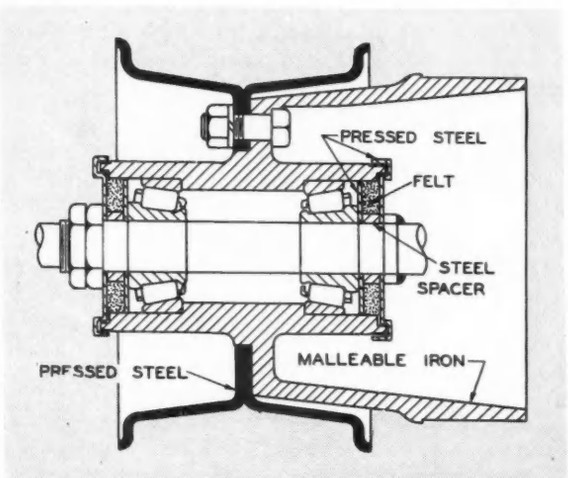
Cushman single-plate clutch assembly for "Motor-Glides".

Accompanying illustrations show several of the engines employed. These range from about 1.5 to 2.5 hp. rating (roughly 11 to 14 cu. in. displacement) and run at speeds up to 4200 r.p.m. The crankcase, cylinder, and cylinder head, among other parts, are gray-iron castings. Crankshafts and connecting rods are among the steel forgings used. One company uses SAE 1035 steel for the crankshaft and SAE X1330 for the connecting rod,

both being heat-treated to give a Brinell hardness of 207 to 241. The same company, Cushman Motor Works, which builds its own engines, employs forgings also for valves (Silchrome), pushrods and camshaft. Other forgings are used for transmission gears (SAE 4150), but some of these are also cut from bar stock. Main bearings are of the Timken roller type. At least one maker of engines uses ball type main bearings for the crankshaft.

It is a common practice to die-cast the flywheel in zinc alloy and to insert therein the permanent magnet for a magneto and sometimes other magneto parts, including a coil, condenser and breaker mechanism. Eisemann Magneto Corp. furnishes a complete magneto built into a flywheel of this type, the flywheel having integral external radial vanes which induce an air flow over the cooling fins cast on the engine cylinder and cylinder head. The flow is directed by a sheet steel housing which encloses the flywheel and is extended above it to include an outlet opposite the cooling fins.

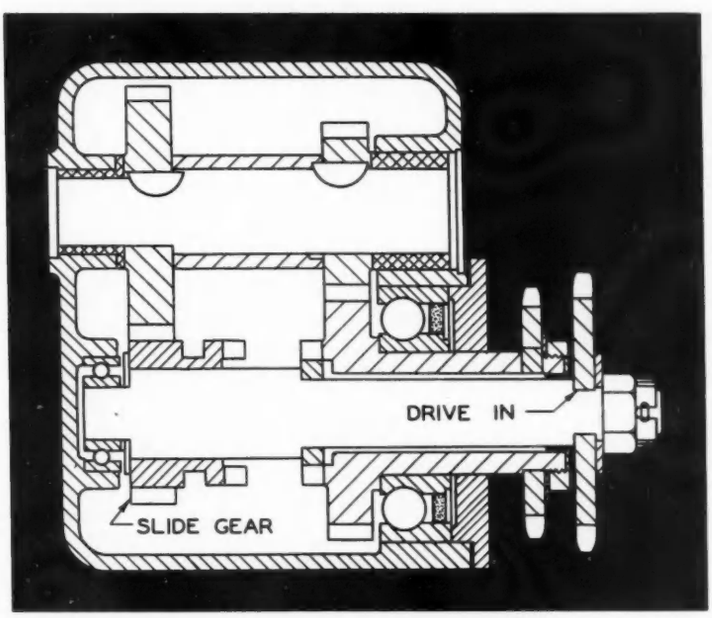
Die-cast zinc-alloy flywheels and magneto plates (the latter forming the end plate for the crankcase) as used in Lauson, Briggs and Stratton, and Johnson engines.



Rear wheel assembly for Cushman "Auto-Glide".

In the Eisemann flywheel, the magnet and other magneto parts are assembled after die-casting, the casting having a rather thin section and the magnet being riveted to the rim. In the Briggs and Stratton flywheel, however, the magnet is cast inside the rim, which is 5¾ in. outside diameter and has a radial thickness of about ¾ in. Also cast in place is a flanged cast-iron hub having a taper bore and keyway, whereas the Eisemann flywheel has a steel hub with taper bore and keyway. Hubs are presumably made in this way to provide a harder keyway than one made directly in the zinc alloy. The Johnson flywheel is 7¾ in. in diameter and also has magnetic inserts cast in place, but there is no insert at the hub, the keyway being in the die-casting itself. An interesting feature of the Briggs and Stratton and Johnson flywheels is the use of integral curved vanes for the blower impeller, presumably requiring less power for

(*See page* 76)



Sectional view of transmission assembly used in some models of Cushman "Auto-Glides".

MEN and MACHINES...

A MICHIGAN manufacturer of heavy-duty truck transmissions—the Fuller Mfg. Co. of Kalamazoo—has solved several machining difficulties by using tools of Haynes Stellite "2400" alloy. Operations on which the company finds this high-production cobalt-chromium-tungsten cutting tool composition especially successful are rough and finish facing of the flywheel housing joint face and rough and finish turning the outside diameter of ring dowel or "pilot."

Roughing the clutch housing faces is accomplished at a surface speed of 105 ft. per min., a feed of 0.010 in. per revolution, and with a depth of cut of $\frac{1}{8}$ in. On the roughing operation, 42 pieces per grind are obtained. Finishing is performed at 155 surface ft. per min., 0.020 in. of feed per revolution, and with 0.010 in. depth of cut.

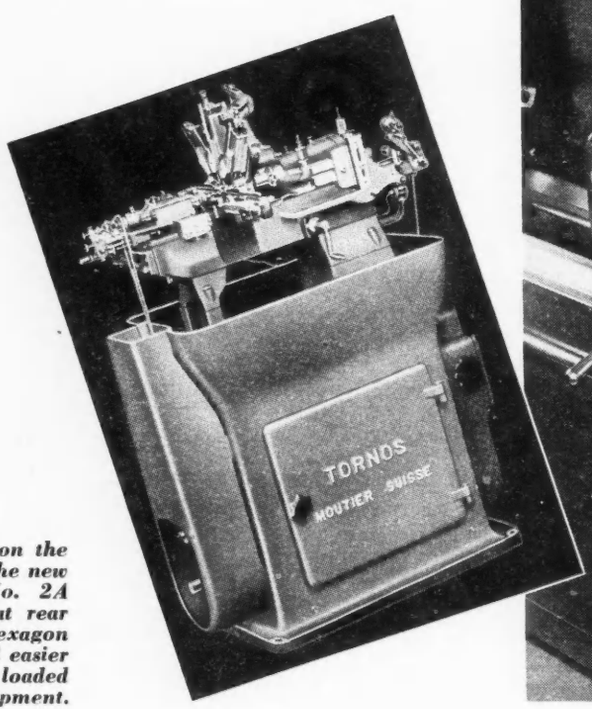
Both of these operations are particularly destructive to cutting tools, as the cuts are taken across the bolt holes. The finishing tool must, in addition, retain a sharp corner to finish the corner of the "pilot." It does its cutting on the point, yet 135 pieces are being obtained per tool grind.

A SADDLE type turret lathe, model 2-A, with an effective swing of 20 in. and a bar capacity through the spindle of $3\frac{1}{2}$ in. is the latest product to come out of the Warner & Swasey plant. Major improvements incorporated in the new machine include a heavier walled hexagon turret, completely redesigned aprons, a new type single lever control for feed selection, a new head brake, and an improved system for lubricating the head stock. A new rigid bed design is now standard, and multiple disk clutches on the rapid traverse not only make it easier to apply power to the turret unit, but give the operator better control over its operation. Rapid traverse nuts are mounted on anti-friction bearings to remove radial loads from the feed shaft proper.

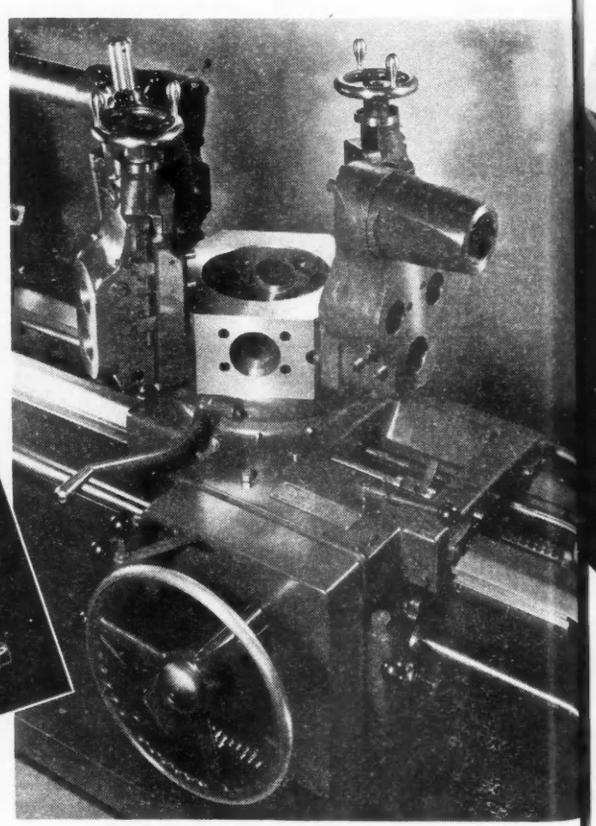
This machine has 12 spindle speeds running in a geometric progression from 17 to 460 r.p.m. With a two-speed motor, double this speed range is available. The universal cross slide has 16 reversible power feeds, which increase uniformly to provide a proper range for all classes of work.

The new Warner & Swasey can be equipped with a cross slide taper attachment, an open type square turret, hand or power feed compound cross slide, independent lead screw attachment, thread chasing attachment, or other auxiliary equipment designed to meet particular production problems.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., has brought out a new cylindrical grinder, known as the type TT, which incorporates a traveling work table and a fixed grinding wheel unit. The machine is equipped with a sensitive reversing mechanism which permits grinding right up to the shoulder of the shaft. Once set, the traverse and reversal of the traveling work table are automatic and require no further attention from the operator.



The improved Swiss automatic screw machine manufactured by Tornos which has been placed on the market in this country by the George Scherr Co., Inc.



Multiple disc clutches on the rapid traverse unit of the new Warner & Swasey No. 2A turret lathes (shown at rear of saddle) make the hexagon turret unit quicker and easier to handle even when loaded with heavy tooling equipment.

a grinder, a lathe, a screw machine and cutting tools of advanced design demand attention

Design of the work table drive has been improved to secure positive, vibrationless traverse, steadiness of travel and smooth, accurate reverse. The table is driven by an adjustable speed reversing motor, through a two-speed drive with accurately generated double helical gears, through worm and worm gear to a worm meshing with a drive rack on the traveling table. Reversal of the table is accomplished electrically. The traveling table itself is made of Meehanite.

The type TT grinder consists of a front bed upon which is superimposed the traveling work table running on inverted V ways. On the traveling table are mounted the headstock, including motor and drive, footstock and neck rests for supporting the object to be ground. A back bed is provided for the grinding wheel unit. This bed is keyed and bolted to the front bed. The wheel head rests on a sub-base which is hinged in front on two tapered trunnions. Interposed between sub-base and back bed is an intermediate base.

Seven motors are required—eight if a taper grinding mechanism is incorporated. Grinding wheel and head stock are driven through V-belt drives and the gear unit for the traveling table is driven by a reversing motor through a V-belt drive.

GEORGE SCHERR CO., INC., New York City, has placed on the market an improved Swiss automatic screw machine manufactured by Tornos, one of the largest screw machine manufacturers in Switzerland. The Tornos line consists of seven models with spindle bores to take bars ranging in size from 5/32 in. to 1 3/16 in. in diameter.

The headstock on this machine feeds longitudinally on the bed for a distance corresponding to the length of the work. Five simple turning tools are arranged radially around the bar stock. The latter is held in a rapidly rotating spindle in the headstock and is fed forward past the turning tools. In order to turn different diameters, shoulders, tapers, or to generate forms of any kind, the tools move in and out by cam motion. No box or forming tools are employed. Spin-

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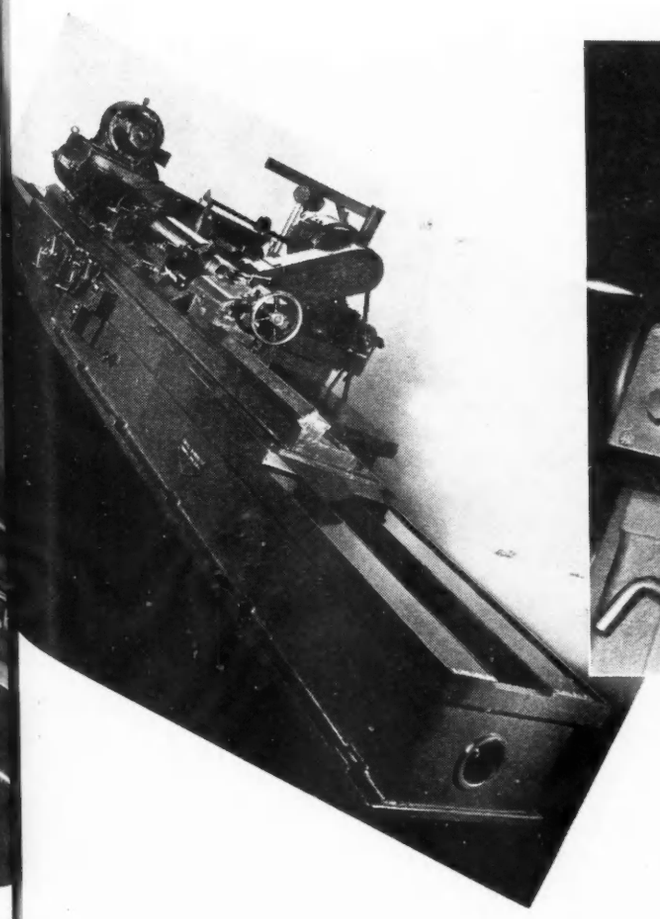
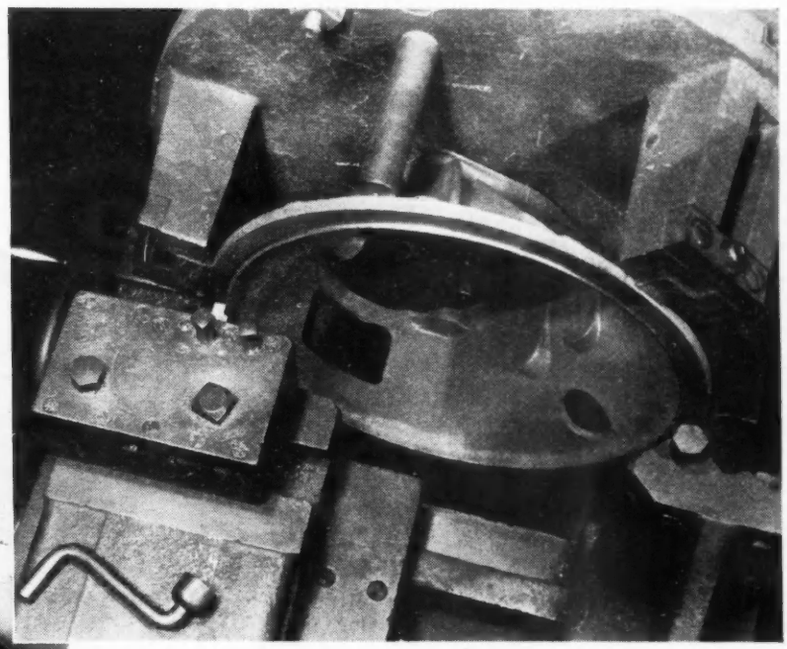




(Above), Rough facing the flywheel housing joint face and rough turning the outside diameter of the "pilot" of a cast iron clutch housing. Tools used are 3/4 in. square Haynes Stellite "2400" alloy.

(Left), Farrel-Birmingham Co.'s new cylindrical grinder with traveling work table and a fixed grinding wheel unit.

New Developments in

Automotive

Carboloy's Extrusion Process for Producing Cemented Carbide

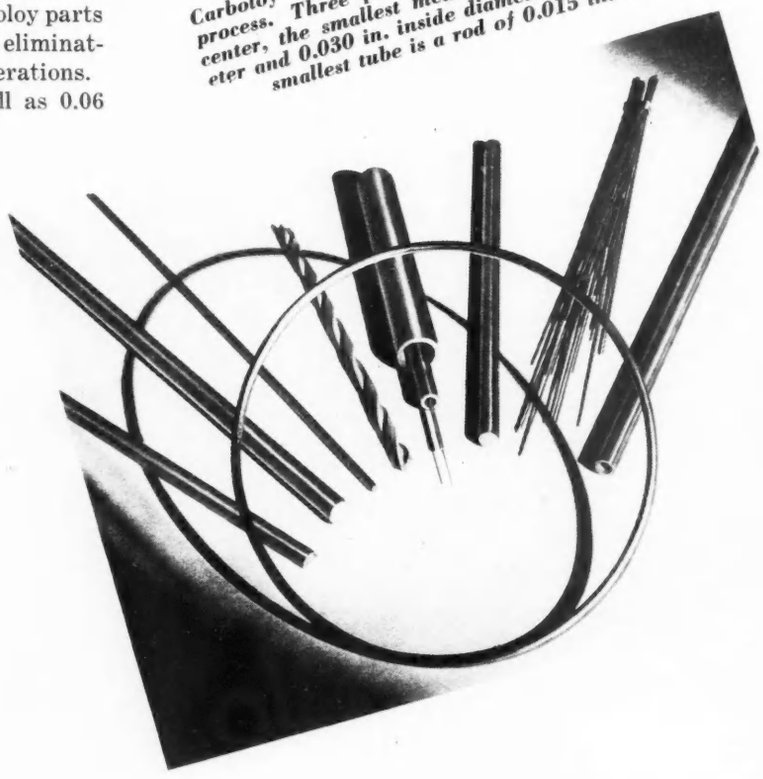
Carboloy cemented carbide now can be produced in the form of tubing, spirals, and round or shaped bars by means of an extrusion process. These rods, spirals and tubes, manufactured by the Carboloy Co., Inc., Detroit, are available in lengths up to 20 in. and within a diameter range of from 0.015 in. to ⅜ in. O. D. Formerly such parts were available only within an extremely limited size range and it was necessary to perform a large part of the shaping operation manually. With the new process now employed, the Carboloy parts are formed directly into the shapes desired, eliminating most of the customary hand forming operations.

The Carboloy tubing can be made as small as 0.06 in. outside diameter by 0.030 in. inside diameter, the wall thickness being 0.015 in. By means of a supplementary process, Carboloy rods, etc., can be bent to various shapes. The five-inch diameter ring illustrated herewith was produced by means of this process. It consists of a round rod curved to form a ring, with the ends joined together.

G. F. Taylor, Carboloy metallurgist, who has been responsible for this development, points out that although most metallic substances in common use can be made in almost any form, drawn into wire, or fabricated into intricate designs, Carboloy has been somewhat limited in these respects. This, he explains, has been due to the fact that the shapes and sizes which could be produced have been limited by the size of the mold which it was practicable to employ to compress metallic powders into adhesive bodies, and to the fact that only a one directional pressure could be effective in forming the object, since dry metallic powders do not obey the laws of fluid pressure. Also there has been a rather definite relation between the transverse and lateral dimensions of the body which could be formed. For example, the length of a rod compressed in the direction of its axis could not be greater than about three times its diameter.

"These limitations," explains Mr. Taylor, "have been overcome by the development of the process which we call extrusion. By this process the dry powder is mixed with a plasticizing medium and can then be formed by extrusion or molding into almost any shape. The method enables us to produce Carboloy which is as good in every respect as that made by the standard cold press or hot press methods.

Carboloy rods, spirals and tubes formed by extrusion process. Three pieces of tubing are illustrated in the center, the smallest measuring 0.060 in. outside diameter and 0.030 in. inside diameter. Protruding from the smallest tube is a rod of 0.015 in. diameter.



A Self-Cleaning and Self-Fluxing Solder

A self-cleaning and self-fluxing paste solder manufactured by the Wayne Chemical Products Co., Detroit, is being marketed under the name "Meltomatic Paste Solder." This new material obviates the need for the melting pot, bar solder, soldering iron, or flux. All

Materials

that is required is a brush to apply the material and a heat source. Meltomatic will melt at a temperature slightly higher than 400 deg. Fahr.

"Duramold"—Material Made of Laminated Wood and Bakelite

A new material said to lend itself to the production of aircraft units in shell form which will take the stresses encountered in flight without the need of reinforcements is discussed in a paper presented before the Society of Automotive Engineers by V. E. Clark of the Clark Aircraft Corp. It is known as "Duramold" and seems to be made up of laminated wood and Bakelite, though no definite description appears in the paper. The specific gravity of Duramold varies between 0.5 and 0.9, and the tensile strength and elastic modulus vary roughly as the density. It is claimed to have a fatigue resistance 50 per cent greater than duralumin.

When considering monocoque structures, the strength of a cylinder under compression loads parallel to the axis of the cylinder is a valuable index. Calculations mentioned in the paper led to the conclusion that for cylinders 60 in. in diameter and a spacing of 30 in. between transverse rings or frames, the weight per foot run being constant, a reinforced duralumin cylinder would support a load of 63,000 lb., a smooth duralumin cylinder 0.032 in. thick, 30,000 lb.; a cylinder of Bakelite reinforced with fabric or cord, 8000 lb., and a Duramold cylinder, 113,000 lb.

Vulcalock Cements Now for Sales on Restricted Basis

Previously sold only under license agreements, the line of Vulcalock cements manufactured by the B. F. Goodrich Co., has been released for sale on a restricted basis. Vulcalock cements, the company claims, permit assemblies previously considered impossible, particularly in making strong, waterproof, chemically resistant joints between rubber and metals. They also are suitable for joining a wide variety of other materials, including many synthetic resins, woods and ceramics.

(*Turn to page* 88, *please*)

Automotive parts, including bearings, bushings, and retainers of bronze composition produced by the porous powder metallurgy developed at the Moraine Products division, General Motors Corp., Dayton, Ohio.

Examples of porous powder metallurgy. A few of these automotive parts, produced by Moraine Products division, General Motors Corp., are of bronze, others are of iron powder. Of particular interest is the oil pump gear used in several passenger car engines. It is of iron, lighter than a machined cast iron gear, has high surface finish and dimensional accuracy, and is said to be less expensive than conventional gears.

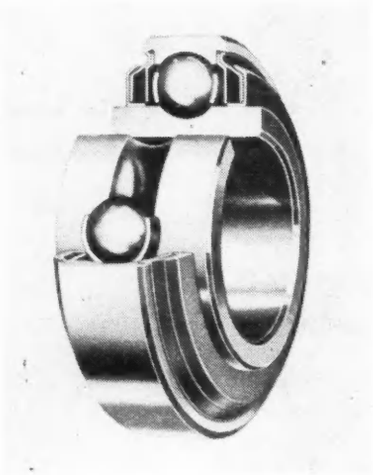
Bermax Babbitt for Rod Bearings

FEDERAL-MOGUL CORPORATION, Detroit, Mich., now offers its high-lead bearing alloy Bermax for use in crankshaft and connecting-rod bearings. This is the same bearing alloy which in the past has been known as L-100, and which is similar to S.A.E. bearing alloy No. 13. It was used first as a lining for camshaft bearings some seven years ago. Formerly high-lead alloys were considered unsuitable for main and connecting-rod bearings, but recent research and development are said to have shown them to possess certain possibilities in fields in which tin-base babbitts are usually used—provided the design and conditions of operations are favorable. Bermax contains from 82 to 86 per cent lead, from 5 to 7 per cent tin, and from 9 to 11 per cent antimony, while the copper content is held to less than 0.25 per cent. The suitability of this alloy for main and connecting rod bearings has been proved by dynamometer endurance tests and by actual use in production for more than a year by one manufacturer each of passenger cars, trucks and Diesel engines.

The new alloy is claimed to be free from the tendency to corrode that is usually associated with high-lead bearing alloys. Bermax is said to be easy to handle and to be well adapted to the rebabbitting of poured steel-back and bronze-back bearings. Federal-Mogul Corporation has issued an engineering report which gives the results of both laboratory and field tests with this bearing alloy as well as instructions for its use.

Mechanical Seal for Ball Bearings

A NEW SEAL for incorporation in ball bearings and which embodies no felt, leather or similar sealing materials, has been developed by The Fafnir Bearing Co., New Britain, Conn. The new seal, which consists solely of steel disks mounted on the inner and outer rings, is said to be more efficient than previous types. As may be seen from the cutaway view reproduced herewith, two widely separated steel disks are mounted in the outer bearing ring and form a trap between them. Another steel disk is pressed on the inner bearing ring and acts as a slinger when the inner ring rotates. There are definite though small clearances between the different members, so there is no mechanical friction at the surfaces of the sealing members. The outer members are rust-proofed. Extensive tests carried out during the two years these seals were under development are said to have proved their effectiveness. These seals are now available as single seals and double seals, and in seal-and-shield combinations on both the radial and the wide-inner-ring bearings of the Fafnir company.



Fafnir ball bearing with Mechani-Seal

Patent Prevents Truck Bottoming

A BRITISH patent has been issued to F. W. Lanchester on a mechanism which automatically raises the frame of a motor truck when it is heavily loaded (to prevent "bottoming"). The spring shackle connects to one arm of a bell crank mounted in a housing underneath the frame side rail. Motion is imparted to the bellcrank by a screw and nut mechanism. On the end of the screw there is a worm wheel with which meshes a worm whose shaft carries a ratchet wheel. This ratchet wheel is acted on by opposite pawls carried on a rocking lever which is connected to the axle by means of a link. When the spring is deflected beyond its normal range, the pawls engage the ratchet wheel and thereby lower the shackle (or raise the frame).

Hypoid Lubricants for Truck Axles

IN a paper presented at the Conference of the new Technologies in Transportation, at the University of Michigan, E. W. Upham, chief metallurgist of Chrysler Corporation, dealt with experimental investigations of EP lubricants for use in truck axles with hypoid-gear drive. What led to this investigation was the fact that occasionally badly-worn differential pinions, side gears and cross shafts were returned to the factory from the field. At first it was thought that this excessive wear was due to overloading of the trucks and excessive differential action, but experiments on the Gleason axle dynamometer showed that this same wear occurred on crosspins if a particular type of EP lubricant was used. The tests established definitely that under conditions of low speed and heavy load, some types of EP lubricants are unsatisfactory for commercial-vehicle axles. In order to determine the relative merits of different EP lubricants for this service, these lubricants were subjected to tests on the Almen bearing- and lubricants-testing machine. The machine was run for a period of 20 minutes, four 2-lb. weights being put on, and the loss in weight of the pins and bushings during this period, and the temperature reached, were noted. This series of runs showed that the lubricants which resulted in a high rate of wear on the Gleason axle dynamometer also gave a high weight loss and a high temperature.

The tests clearly distinguished the so-called active from the inactive or mild EP lubricants. With the former the weight loss averaged between 35 and 55 milligrams, while with the latter it varied between 0.5 and 4 milligrams. The average temperature of the bath of the former was well above 300 deg. Fahr. whereas with the latter the temperature ranged between 125 and 212 deg. It very soon became apparent that the lubricants of high chemical activity were not suitable for the rear axle of commercial vehicles. An easy field test for such lubricants consists in immersing a polished copper strip in them. If the copper turns black the lubricant is of the active type.

The types of lubricant that are unsuited for commercial-vehicle rear axles

are those containing considerable quantities of active sulfur. On the S.A.E. machine such lubricants show the ability to carry extremely high loads. On the Timken machine they always show high wear. They therefore combine the advantage of high load-carrying capacity with the disadvantage of rapid wear of the lubricated parts. Chrysler Corporation now uses the classification of truck-duty hypoid and passenger-car-duty hypoid lubricants, and Mr. Upham expressed the opinion that this would become general.

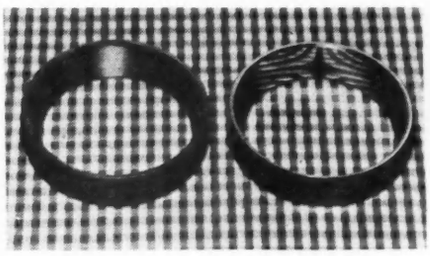
Chrysler's present routine test for axle lubricants is as follows: The lubricant is first examined in the chemical laboratory and then two runs are made on the axle dynamometer, the first being a differential-gear check, the second a ring-gear-and-pinion check. A new production differential assembly is installed in a rear-axle housing and placed in the dynamometer. The housing is filled with lubricant to the normal level, and the dynamometer is operated at 80 r.p.m. axle-shaft speed under an axle-shaft torque of 10,000 lb-in. (full engine torque through second gear) for 24 hours. Every four hours the machine is reversed, and the oil is kept at between 180 and 200 deg. Fahr. For the differential check one side of the dynamometer is locked, so that 100 per cent differential action is obtained.

New carriers are installed for the ring-gear and pinion check, and the dynamometer is run to give an axle-shaft speed of 125 r.p.m. (equivalent to 10 m.p.h. truck speed) and under a torque of 23,400 lb.-in. (full engine torque through low gear). Oil temperature is kept within the same limits as in the differential check. The ring gear and pinion are inspected after one million revolutions of the pinion. The appearance of the tooth surfaces of ring gear and pinion after this run is a measure of the ability of the lubricant to carry the imposed load. Some change is always noted, though it may be only a slight burnishing or polishing, the original cutter marks still being visible. With active sulfur lubricants and the loadings specified, a rippling or series of small waves is frequently observed. A lubricant of too little load-carrying capacity results in scoring, which is unmistakable. Scoring has been referred to as temporary welding, and good hypoid lubricants possess anti-weld properties.

If an addition of sulfur-saponifiable base is made to straight mineral oil, the load which the oil will sustain without injurious results is increased. If an addition of chlorine or of phosphorus compound is made to this compounded oil, additional protection against injury to the teeth is obtained.

Micro-Honing — a New Surface Finish

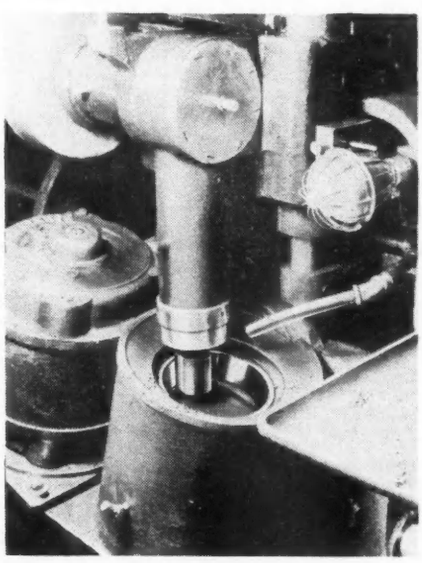
BOWER ROLLER BEARING CO., Detroit, Mich., now employs a new surface-finishing method, developed by it and known as micro-honing, in the production of its roller bearings. The "micro-honed" finish, applied to the bearing surfaces, is produced by fixed honing stones so mounted in oscillating holders that, with the work rotating at predetermined speeds, the honing stones follow different paths during successive cycles. Positive relations between the movements of the stones and the work result in the removal of what is described as amorphous surface metal, preventing the stones from following contours or surface irregularities. By removing the amorphous surface layer



Comparison of finish grind and micro-honing on a bearing cup

the process is said to leave a smooth surface on the hard base metal, with only minute scratches below the bearing surface. These scratches have a depth of the order of three micro-inches (0.0003 in.), and all are below the surface; there are no projections above the surface which might rupture the thin oil film upon it.

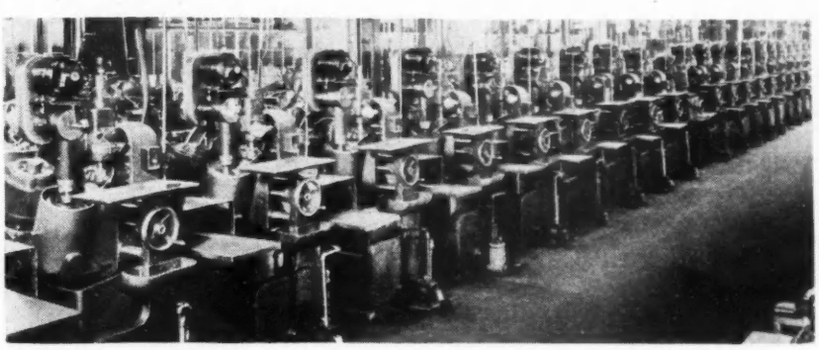
Among the advantages claimed for the micro-honed finish are that it gives positive control of fine dimensional tolerances; that it permits of permanent adjustment of the bearings when first installed, eliminating the need for a final adjustment after a "break-in" period, and that it increases the load capacity of the bearing because the smoother bearing surfaces reduce the likelihood of oil-film failure.



Close-up of micro-honing on a large bearing cup

Lubriflush Motor Lubrication System

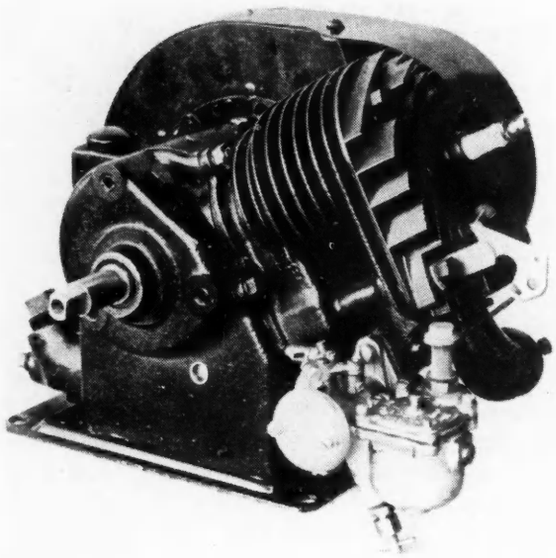
This system of lubrication for electric motors, developed by U. S. Electrical Motors, Inc., Los Angeles, Calif., flushes the bearings when lubricating them. Through a duct leading from the outside of the motor, new lubricant is injected to the inner side of the bearing with a pressure gun. There is a drain hole at the bottom of the bearing on the opposite side. As new lubricant it injected, the old lubricant is forced out, and before the new lubricant reaches the drain, it must first flush the entire bearing and chamber. The grease fitting and drain plug are easily accessible.



Semi-automatic machines to micro-hone bearing cups and cones

Scooters Open New Automotive Markets

(Continued from page 69)



Johnson engine, produced by the Johnson Motor Division of Outboard Marine & Mfg. Co., Milwaukee.

air circulation than with the use of straight vanes.

The Lauson engine, used on some Moto-Scoots, the Briggs and Stratton engine, used on other models of the same make, and the Johnson engine, used on the Salsbury Scooter, employ die-cast zinc-alloy side plates to close the flywheel side of the crankcase. These, all of which are illustrated, provide good seats for inserted bearings and include bosses for mounting magneto parts.

Other die castings used in or on scooter engines include oil-pump bodies, valve-spring covers, breather bodies and complete carburetors.

An accompanying drawing shows one of the few change-gear assemblies (Cushman) employed in scooters. This has a cast-iron housing and makes use of two ball bearings on the main shaft. Other Cushman units shown include a single-plate clutch with ball-type throwout bearing, and a rear wheel assembly using a pair of taper roller bearings. The hub itself is of malleable iron and has bolted to it a pair of pressed-steel parts forming the tire rim.

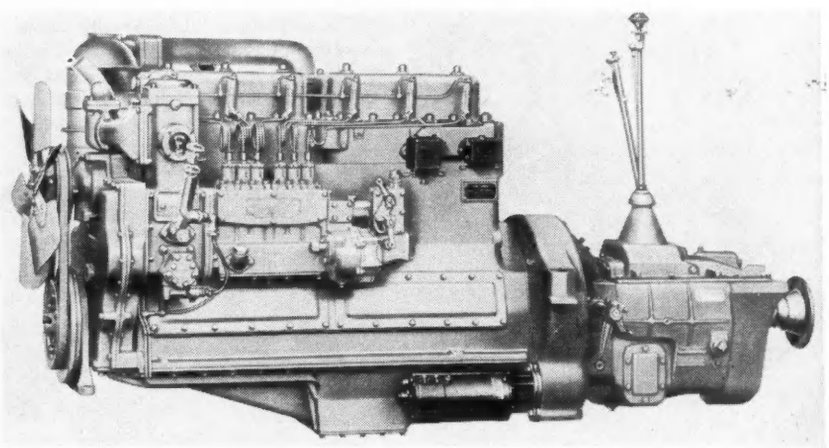
Considerable welding is done in building up frame structures from pressed steel, rolled sections and tubing, as will be observed by reference to illustrations.

Caterpillar Offers Diesel-Type Truck Engine

CATERPILLAR TRACTOR COMPANY has entered the automotive field with a 90-hp. Diesel truck engine.. It has a six-cylinder, four-stroke engine of 4¼ in. bore and 5½ in. stroke which develops its maximum horsepower at 1800 r.p.m. The maximum torque of 305 lb-ft. of this 468-cu. in. engine is developed at 900 r.p.m. For use as a replacement unit the engine is equipped with a Spicer friction clutch and five-speed transmission.

The engine is of Caterpillar's prechamber type. Injection pumps and valves are set at the factory and require no adjustment in the field. Engine block and cylinder head are alloy iron castings, while the pistons are of aluminum alloy. Water is circulated by a pump and the water temperature is controlled by a thermostat. An oil cooler is provided and uses air as the cooling medium.

There are seven main bearings on the crankshaft of 3-in. diameter and with a total bearing surface of 118 sq. in. Connecting-rod bearings are of 2⅝-in. diameter and 1⅞ in. long. The crankshaft is fitted with a torsional vibration damper. Lubrication is by pressure to all main, connecting rod, piston-pin and camshaft bearings and to the valve-operating mechanism and timing gears. Main and connecting-rod bearings are of the precision type. The lubricating system has a capacity of 4¼ gals. With the engine under maximum load, heat is dissipated by the cooling water at the rate of 4060 B.t.u. per minute. The net weight of the engine dry is 2120 lb.



Caterpillar Model D468 truck engine equipped with Spicer clutch and transmission

NEWS OF THE INDUSTRY

Preliminary Statistics for the Industry in 1939—see page 85

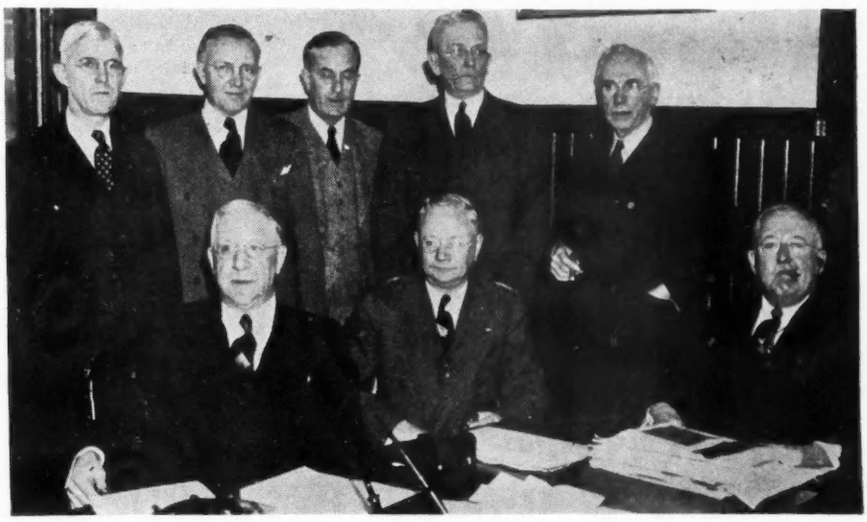
Loss Reported By Continental

Continental Motors Corp. and subsidiaries report a net loss of $215,164.95 for the year ended Oct. 31, 1939. For the year ended Oct. 31, 1938, a loss of $548,286.95 was reported. The company stated that it had unfilled orders on hand of $5,866,000.00 at the close of the fiscal year.

GM Produces Its 25,000,000th

On Jan. 11 the 25,000,000th General Motors car left the assembly lines in Flint. To celebrate the occasion W. S. Knudsen, president of the corporation, invited approximately 5,000 people to attend a "family party" held that evening. A special program was held in honor of veteran employes and a musical and dramatic presentation with a cast of 300 provided entertainment.

The 25,000,000 cars, built since 1908, included the products of Oldsmobile, Cadillac and Buick, which were already established at the birth of General Motors, and of Pontiac, Chevrolet and LaSalle, which later became members of the GM "family."



Directors of Reo Motors, Inc.

Members of the new board of directors of Reo Motors, Inc., as they met for their first session. Only six of the seven directors were present, Edward Ver Linden, of Detroit, being unable to attend. They are shown meeting with Theodore I. Fry, trustee, whom they elected vice-president, and Byron L. Ballard, attorney for the trustee. From left to right, standing, they are: Andrew J. Langenbacker, Mr. Ballard, Otto C. Seyferth, Colonel Fred Glover, elected president and general manager, and J. W. Wilford. Seated are Mr. Fry, Hugo Lundberg and A. I. Philp.

Reo Reorganization Completed; "Reo Motors, Inc." Is New Name

Production of Trucks and Buses Expected to Start Before March 1

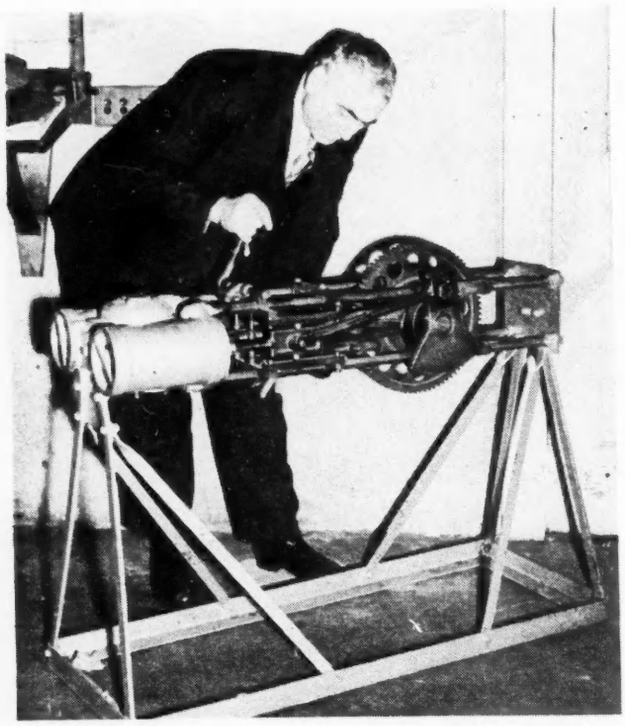
Naming of directors and officers, changing of the firm name to Reo Motors, Inc., and filing of articles of incorporation with the Michigan Corporations and Securities Commission early in January completed reorganization procedure of the former Reo Motor Car Co. and cleared the decks for operation which will permit the company to engage actively in the production of motor trucks and buses. New directors, named by the three-man voting trust, were approved by Arthur F. Lederle, judge of the U. S. District Court, who approved the reorganization plan which had been in litigation for approximately a year.

Directors on the new seven-man board are: Col. Fred Glover, Detroit, who served as general manager of the company during the reorganization period; Andrew W. Langenbacher, Lansing, president and general manager of Duplex Truck Co.; Edward VerLinden, Detroit, formerly associated with Oldsmobile and at one time its president; Hugo Lundberg, Lansing, president of Lundberg Screw Products Co.; A. I. Philp, Detroit, at one time associated with Durant Motors in Lansing; and J. W. Milford, Lansing, president of Melling Forging Co. and the Bank of Lansing. Seventh member of the board is Otto C. Seyferth, who is the representative of the three-man voting trust on the board.

Colonel Glover was named president and general manager of the new company at the first meeting of the directors in Lansing on Jan. 3. Other officers are: Theodore I. Fry, trustee of the company during the reorganization period, vice-president; W. C. Wood, secretary-treasurer; and R. F. McKim, assistant secretary-treasurer; F. L. Brooks, credit manager; F. N. Morgan, general sales manager; D. C. Streeter, assistant general sales manager; J. T. Clark, export sales manager; S. E. Heydenfeldt, service manager; A. W. Zimmer, factory manager; R. K. Jack, chief engineer; G. Tooker, assistant chief engineer. It is expected that actual production of trucks and buses will be under way before March 1.

Murray Corp. Reports Three-Month Profit

Net profit of the Murray Corp. as reported for the three months ended Nov. 30, 1939, was $203,069.51, after provision for depreciation of $174,652.81, and after deduction of all expenses and reserves, including taxes. Gross profit from sales, before deducting provision for depreciation, was reported at $675,345.98 for the same period.



Acme

Steamer

Fred Marriott, of Watertown, Mass., is shown with the engine of a Stanley Steam Automobile he drove at a record speed of 128 m.p.h. at Daytona Beach in 1906—a record that still stands in the steam class. Mr. Marriott is presenting the car and engine to the Smithsonian Institute.

NLRB Orders Investigation to Determine Bargaining Units

Board Acts on Petitions by AFL-CIO

Elections Expected for Decisions

An investigation and hearing to determine whether unions affiliated with the CIO or AFL are proper bargaining units in 67 General Motors plants was ordered by the National Labor Relations Board on Jan. 4. The board acted on petitions of both AFL and CIO unions and dismissed a third petition to the same effect filed by General Motors itself.

While the investigations and hearings may make it possible to determine proper bargaining units it is expected that in most instances elections will be held. Date of the hearings and name of the trial examiner have not yet been set, but are to be announced by the Detroit NLRB regional director, Frank H. Bowen. If elections are ordered it will be necessary to determine whether they shall be held on a plant-wide or corporation-wide basis; and in either case will be the largest election ever held under NLRB auspices.

Petitions were filed with the NLRB by both the UAW-CIO and the UAW-AFL. In a number of plants petitions also were filed by the Pattern Makers League of North America, and the International Association of Machinists and Operating Engineers, both of which are AFL unions. The 67 plants are located in 11 states but most of them are in Michigan with 21 in Detroit. The plants involved are:

(*Turn to page* 88, *please*)

Estimated Dealer Stocks of New Passenger Cars

1938	July	August	September	October	November	December
Production—U. S. Domestic Market †	96,975	53,955	60,177	171,371	295,366	305,900
Retail Sales—U. S. ‡	153,426	123,711	90,629	134,984	241,009	241,623
Change in Inventory	−56,451	−69,756	−30,452	+36,387	+54,357	+64,277
Inventory, first of month	263,618	207,167	137,411	106,959	143,346	197,703
1939	**January**	**February**	**March**	**April**	**May**	**June**
Production—U. S. Domestic Market †	263,225	223,745	279,148	257,058	222,909	233,311
Retail Sales—U. S. ‡	180,651	165,841	276,301	265,756	275,457	254,604
Change in Inventory	+82,574	+57,904	+2,847	−8,698	−52,548	−21,293
Inventory, first of month	261,980	344,554	402,458	405,305	396,607	344,059
1939 (continued)	**July**	**August**	**September**	**October**	**November**	**December**
Production—U. S. Domestic Market †	142,346	56,233	155,430	239,150	272,747	.....
Retail Sales—U. S. ‡	229,873	166,172	139,660	236,180	257,336	.....
Change in Inventory	−87,527	−109,939	+15,770	+2,970	+15,411	.....
Inventory, first of month	322,766	235,239	125,300	141,070	144,040	159,451

†—U. S. Census Bureau. ‡—Automobile Manufacturers Association.

CENSORED

An exclusive feature prepared by the London correspondent of AUTOMOTIVE INDUSTRIES, *M. W. Bourdon.*

The output of passenger cars in England remains at about 20 per cent of capacity and is being devoted largely to fulfill export demands, which have not fallen off with the war but rather have tended to increase.

The home demand for 8 hp., 10 hp. and 12 hp. models has also increased since October, but manufacturers are unable to meet it in full, owing to production being restricted by the shortage of material supplies. Stocks of components are nearly exhausted in many cases and cannot be replenished to the extent required, owing to suppliers being obliged to give priority to government orders and munition work.

Although not officially announced, the government has agreed to assist the industry as a whole to obtain materials sufficient to permit output to be maintained at approximately 20 per cent of capacity, as regards both cars and trucks, while demand calls for it, but with the proviso that at least half of the output shall be exported.

One of the Big Five among British makers is more or less typical of the remainder in having grouped all its war-time manufacturing equipment in one shop—which, in this case, was the paint-shop prior to the war. All other shops have been or are being denuded of their usual equipment, assembly lines, conveyors, etc., to make room for airplane production. As much the same thing is happening in other plants, output could not be increased to any extent while war conditions prevail, even if materials were available.

Sales of used as well as new cars practically ceased for a while on the outbreak of war, but have since revived to some extent. Moreover, for the instruction of recruits for the mechanized branches of the British Army, thousands of used cars of small sizes have been purchased from dealers.

* * *

The English Ford Company has introduced a special model of the 10 hp. type with a large capacity delivery van body that is capable of being quickly converted into an ambulance. The price is £200.

* * *

Owing to all available supplies of aluminum being needed for airplanes and other war purposes manufacturers of all kinds of motor vehicles for civilian use are now compelled to displace light alloys by heavier materials.

Ourselves & Government

A Check List of Federal Action Corrected to Jan. 9

Federal Trade Commission

F.O.B. PRICE CASE—Trial examiners' hearing held in Ford case in Detroit on Nov. 2. Next step will be trial examiners' report. Testimony closed in GM case, with trial examiners' report having been served on respondent company. After final arguments, the FTC order is next in line. Both cases involve the FTC allegation that the companies engaged in misleading price advertising.

VS. GENERAL MOTORS—Trial examiners' report due. Rebuttal testimony concluded Sept. 11. The FTC charge is that GM dealers are required to handle GM parts exclusively.

FAIR TRADE PRACTICE RULES—No indication when rules, now long overdue, will be promulgated.

National Labor Relations Board

Three unanimous Supreme Court decisions upholding far-reaching powers of the National Labor Relations Act to determine collective bargaining units stimulated demand in Congress for revision of the Wagner Act. While there was no lessening of criticism of administration of the law by the present board it was conceded that the court decisions made it clear that the remedy for complaints against the situation lies with Congress. Comment in Congress on the decisions showed that a strong effort will be made to have the act amended at the present session. It is believed that support for this move may be expected from not only the special House Committee which is investigating operations of the act and its administration by the board, but the AFL, defeated petitioner in two decisions, will intensify its drive to have the act revised to meet its demand, particularly as to compelling wider board recognition of the craft union.

Temporary National Economic Committee

The Temporary National Economic (anti-monopoly) Committee has decided to review the subject of technological development and its relation to employment and will investigate a large number of industries, including the machine tool industry especially. The new TNEC case study, to be entitled "The Impact of Technological Development upon Employment," is similar to one conducted a few years ago by the Works Progress Administration. Several bills have been introduced in Congress in the past few years to further investigate the subject and extensive hearings were conducted on two of the measures several years ago.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

General business activity of the year-end remained near the 1939 peak. The New York *Times* seasonally adjusted index for the week ended Dec. 23 stood at 105.7 per cent of the estimated normal, as compared with 106.6 a fortnight earlier. After a decline of 3.5 points during that period, *The Journal of Commerce* unadjusted index, at 104.3 per cent of the 1927-29 average, was 1.1 points above the level recorded four weeks earlier.

Retail trade during the last two weeks of December ranged from 2 to 13 per cent above corresponding 1938 levels, according to Dun & Bradstreet estimates, with the indicated sales volume of the holiday season the largest in 10 years. Department store sales during the week before Christmas were 13 per cent greater than a year ago, according to the Federal Reserve compilation.

Production of electricity by the power and light industry during the week ended Dec. 23 soared again to an all-time peak, exceeding by 11.8 per cent the output a year ago.

The movement of railway freight in the same period continued a less than seasonal decline. Loadings totaled 654,817 cars, 26,349 fewer than for the preceding week but 14 per cent more than the corresponding 1938 figure. Preliminary estimates for the final week of 1939 indicate, with seasonal adjustment, the year's maximum traffic.

Business failures during the week ended Dec. 28 numbered 136, according to the Dun & Bradstreet report, as compared with 200 in the week before and 236 a year ago.

Average daily production of crude oil during the final week of December dropped to 3,545,000 barrels from 3,867,900 barrels for the preceding week and was 74,700 barrels below the required output as calculated by the Bureau of Mines.

Production of bituminous coal during the week ended Dec. 23 averaged 1,496,000 tons daily, as compared with 1,445,000 tons for the week before and 1,388,000 tons a years ago.

Engineering construction contracts awarded last year were 8 per cent above the 1938 total, according to *Engineering News-Record*. The gain in private work was 11 per cent, as compared with 6 per cent for public projects. In the final week of the period private awards were 24 per cent greater than a year ago, as against a drop of 37 per cent in public contracts.

Cotton-mill activity declined more than seasonally in the week ended Dec. 23; The New York *Times* adjusted index stood at 146.4, as compared with 148.7 for the preceding week and 113.3 a year ago.

Professor Fisher's index of wholesale commodity prices for the last week of 1939 registered the year's peak, standing at 86.2 per cent of the 1926 average, or one point above the level a fortnight ago, as against a low of 77.8 for the third week of August.

Excess reserves of the member banks of the Federal Reserve system rose $150,000,000 in the week ended Dec. 27 to an estimated total of $5,050,000,000. Business loans of the reporting members on that date, $4,400,000,000, were $16,000,000 below the total two weeks earlier but $557,000,000 greater than a year ago.

NSPA Index Reveals November Sales Drop

Automotive sales for November, according to the National Standard Parts Association index, showed a seasonal decline of four per cent from 164 in October to 157 in November, but this was 12 per cent above November of 1938. Replacement parts shipped to wholesalers in November also declined, from 164 to 150, or nine per cent. However, November, 1939, was 11 per cent above the same month in 1938. The monthly average for the eleven months was 18 per cent above the same period in the previous year.

Original equipment shipped to vehicle manufacturers in November advanced two per cent over October, 12 per cent over November, 1938. The average for 11 months was 40 per cent ahead of 1938. Export shipments in November jumped ahead of October by seven per cent and were three per cent ahead of November, 1938. Average monthly exports for the eleven months registered nine per cent ahead of 1938.

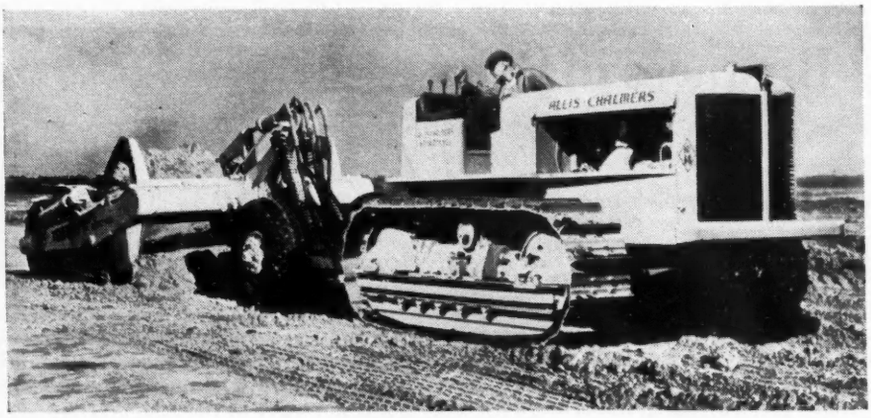
The Motor and Equipment Manufacturers Association grand index for all branches of the industry in November declined to 135 per cent of the January, 1925, base as compared with 146 per cent for October and 136 per cent for November, 1938.

40 YEARS AGO

At the Winton Motor Carriage Co. factory, Cleveland, O., preparations are being made to double the force of workmen and turn out not less than one complete carriage a day. They report a call for a faster machine and are consequently equipping their 1900 Special with 9-h.p. motors and 4-in. driving tires. The body will be modeled after the racing machines of France, a tool box taking the place of the dash in front. In response to a demand for more seating capacity they are manufacturing a two-seated extension top family carriage, geared for a maximum speed of 15 miles an hour.

They are paying special attention to the finish of their machines, but in point of general effect they will adhere to the red running gear and dark Brewster green body which are distinguishing characteristics of their output.

From *The Horseless Age*, January, 1900.



Allis-Chalmers' New Diesel Crawler Line

A new line of high speed Diesel crawler tractors, powered by General Motors Diesel engines, has been announced by Allis-Chalmers Manufacturing Co. The first of this line, the HD14 shown above, is now available and other models will be released soon. The HD14 develops 130 hp. on the belt, 106 hp. on the drawbar and weighs 27,000 lb. The transmission with six forward speeds and two reverse provides forward speeds from 1.72 to 7.00 m.p.h. and reverse speeds of 2.00 and 3.20 m.p.h. Standard equipment on this tractor includes heavy radiator guard, crankcase guard, wheel guards, front pull hook and muffler. Radiator shutters and electric starting are also standard equipment.

Little Change in Steel Price Trend Seen for '40

Next Few Months' Car Sales Will Influence Shaping of Market

With their nearby steel requirements taken care of, automobile manufacturers are feeling out the market regarding the price set-up that will confront them when the time for fresh buying comes. It is recognized by fair-minded steel users that steel mill production costs have gone up and that there is little likelihood that there will be a change in this trend in 1940. On the other hand, large buyers, such as the automobile manufacturers, feel that publicized prices fail to differentiate sufficiently between the general run of steel consumers and heavy tonnage buyers of highly finished forms of rolled steel, such as body and fender stock. Rejecting, therefore, these publicized prices as a criterion, this exceptional class of consumers emphasizes as yardstick comparison with the prices at which they bought steel in 1939, showing the buyer's natural resistance to advances. This attitude is all the more pronounced as automotive production costs generally are on the uptrend. Automobile sales in the next few months will naturally exert considerable influence on the shaping of the steel market in 1940. That steel mills operated at near-capacity rates toward the end of last year, has, however, not dampened the competitive ardor of steel makers and this factor assures amicable adjustment of differing price views through compromise. The momentum of automobile production continues to impart activity to any specialty mills aside from the continuous sheet and strip rolling units. Makers of mechanical tubing have good-sized orders from automotive consumers. Takings by the latter of wire and wire products furnish the chief prop for a continuing good rate of operations of wire drawers. Steel mill operations the week ending Jan. 6, according to the American Iron & Steel Institute, were at 85.7 per cent of ingot capacity, compared with 73.2 per cent during the preceding five-day Christmas week. The rebound from this low for the present movement was not as large as had been expected by some.

Non-ferrous metals opened the new year rather quietly. Straits tin eased off to 49 cents a pound on Jan. 2. To liven things up a bit, a rumor was circulated that the Russians had bought a round tonnage of tin in the United States. Pending further information on the subject, the market was skeptical regarding the rumor. Copper was steady and quiet. The annual report of the sole producer of virgin aluminum in the United States speaks of steadily increasing purchases of the metal by motor truck manufacturers—W.C.H.

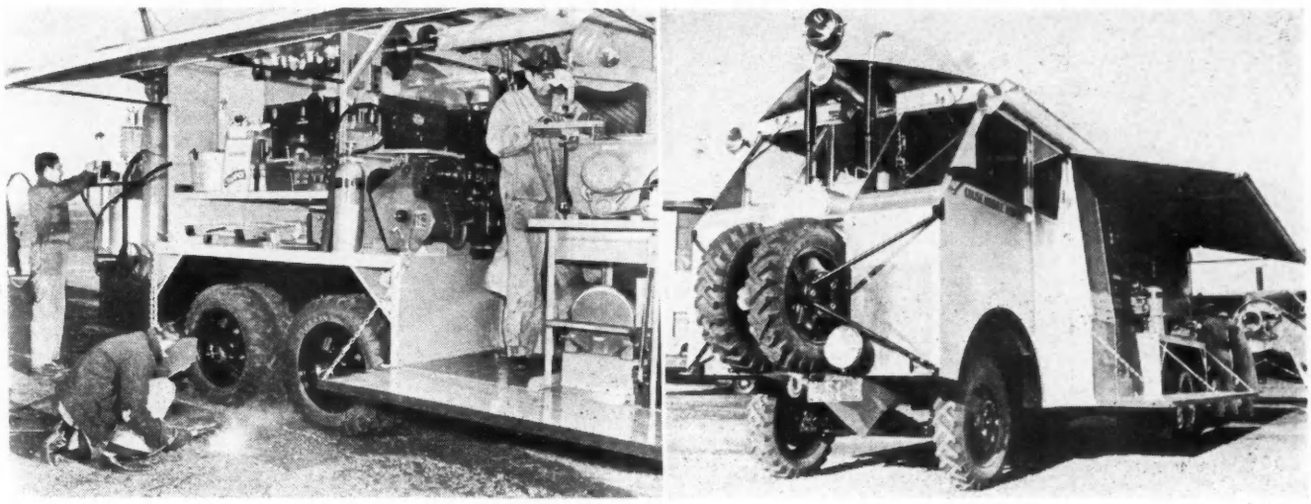
Passenger Car and Truck Production

(U. S. and Canada)

	November 1939	October 1939	November 1938	ELEVEN MONTHS 1939	ELEVEN MONTHS 1938	Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	272,747	239,150	295,366	2,344,457	1,504,929	+56.0
Foreign Market—U. S.	12,505	12,669	24,978	148,512	170,050	−12.6
Canada	9,882	7,791	15,423	97,315	109,563	−11.1
Total	295,134	259,610	335,767	2,590,284	1,784,542	+45.0
Trucks—U. S. and Canada						
Domestic Market—U. S.	55,250	50,888	38,771	498,521	304,062	+64.0
Foreign Market—U. S.	11,280	10,670	13,298	133,544	121,698	+ 9.9
Canada	8,530	1,849	2,569	41 023	37,909	+ 8.2
Total	75,060	63,407	54,638	673,088	463,669	+45.2
Total—Domestic Market—U. S.	327,997	290,038	334,137	2,842,978	1,808,991	+57.4
Total—Foreign Market—U. S.	23,785	23,339	38,276	282,056	291,748	− 3.2
Total—Canada	18,412	9,640	17,992	138,338	147,472	− 6.1
Total—Cars and Trucks—U. S. and Canada	370,194	323,017	390,405	3,263,372	2,248,211	+45.0

Canada Watches the Australian Subsidy

Canadian government trade experts are watching closely Australia's new subsidy plan to develop an automobile manufacturing industry, because it may affect export of Canadian-made vehicles to Australia which exceeded $8,000,000 in 1938. However, experts said the full effect of the Australian plan on the Canadian automobile export business may not be apparent for several years, since it takes five years or so for such a new industry to develop. In that time Canadian exporters may adapt themselves to the new situation so that manufacturers here would not be adversely affected by the Australian venture. For instance, Canada might increase exports of automobile parts and accessories instead of sending the assembled or partly-assembled product. L. M. Cosgrave, Canadian Trade Commissioner in Sydney, has reported to the Dominion Government at Ottawa, that: "the Commonwealth Government announce allocation of £1,500,000 ($5,340,000) as a subsidy for motor car manufacture.



Acme

Mobile Airport

Two views of the Couse Mobile Airport as it was demonstrated recently at the Newark, N. J., airport. Unconfirmed reports indicate that four of these 13-ton, $50,000 vehicles have already been ordered by an Allied power. All mechanical equipment necessary for an emergency airport is carried in the truck and workmen are enabled to make repairs to disabled fighting craft on the spot. Side view shows the carpentry shop with lathes, compressors, dynamos, etc.

Set $156,000,000 For Highway Aid

WASHINGTON—The new Federal Works Agency, which now has jurisdiction over the Federal-aid highway system, has apportioned among the 48 states, the District of Columbia, Hawaii and Puerto Rico, $156,000,000 for highway improvement and elimination of railroad grade-crossing hazards. Available from appropriations authorized for the fiscal year begining July 1, 1940, after deductions of amounts for administrative expenses, the apportionment was authorized by the Act of June 8, 1938, which provided $115,000,000 for improvement of the Federal-aid system and its extensions through cities, $15,000,000 for improvement of secondary or feeder roads, and $30,000,000 for elimination of railroad grade-crossing hazards.

As in former years, the highway funds were apportioned among the states in proportion to population, area, and mileage of rural post roads. Grade crossing funds were apportioned, one-half on the basis of population, one-fourth on the basis of mileage of the Federal-aid system, and one-fourth according to railroad mileage. Under the system, no state can receive less than one-half of one per cent of an apportionment.

To be under the supervision of the Public Roads Administration, formerly the Bureau of Public Roads of the Department of Agriculture, expenditures will be made in accordance with the Federal-aid plan in operation since 1916. Selection of projects rests with the State highway departments which also prepare plans, let contracts, and supervise construction, all of which is subject to approval by the Federal Government.

Figures released by the Federal Works Agency show that during the past fiscal year, highway work in cooperation with state highway departments resulted in the improvement of 9786 miles on rural portions of the Federal-aid system, 2971 miles on the secondary or farm-to-market systems, and 725 miles were improved in municipalities.

J. E. Frantz

J. E. Frantz, president of Landis Tool Co., died recently in Waynesboro, Penna., at the age of 72, after an extended illness. For years he had been one of the country's leading machine tool manufacturing executives. In 1890 he associated himself with Landis Brothers shortly after they began the manufacture of the first Landis grinders. When the plant was destroyed by fire in 1897 he was largely responsible for the formation of the present organization and became its first secretary and treasurer.

Powder Metallurgy Laboratory Opens

A laboratory of powder metallurgy will be opened Feb. 1 by the Graduate School of the Stevens Institute of Technology, Hoboken, N. J. It is planned to serve as a training ground to provide industry with competent researchers in this field. Gregory J. Comstock has been appointed associate professor of metallurgy and Dr. Claire C. Balke as assistant professor of metallurgy, the latter on a full-time basis. Professor Comstock, a pioneer in industry in the development of powder metallurgy, will undertake his laboratory duties in addition to his practice as consulting engineer on the subject.

U. S. Co. Reports Profit

For the three months ended Nov. 30, 1939, United Specialties Co. reports a net income of $64,609.61. Gross sales for the same period were reported as $493,211.81.

Monthly Motor Vehicle Production (U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1939	1938	1939	1938	1939	1938
January	291,444	168,890	62,502	58,062	353,946	226,952
February	250,897	151,133	61,244	51,464	312,141	202,597
March	312,392	186,341	77,097	52,106	389,489	238,447
April	286,200	190,111	68,063	47,818	354,263	237,929
May	249,455	168,599	63,759	41,575	313,214	210,174
June	257,289	147,545	66,946	41,857	324,235	189,402
July	155,850	112,114	62,628	38,336	218,478	150,294
August	62,452	61,687	40,891	35,259	103,343	96,946
September	165,119	69,449	27,553	20,174	192,672	89,623
October	259,610	192,906	63,407	22,380	323,017	215,286
November	295,134	335,767	75,060	54,638	370,194	390,405
December	.....	341,524	.....	65,492	.....	406,960
Total	.....	2,126,066	.....	529,161	.....	2,655,171

International

Mystery Plane at Capital

The Navy's newest warplane, the XPBY-5A, world's largest amphibian long-range patrol bomber, as it arrived in Washington after a flight from San Antonio, Texas. The plane has a wingspread of 104 ft., length 65 ft. Most of its specifications and ordnance are a closely guarded secret.

GM Extends Employe Layoff Benefit Plans

General Motors last year inaugurated the Income Security Plan and the Layoff Benefit Plan in order to assist employes by wage advances in periods of low employment or layoff. The purpose of the plans as stated at that time was to provide greater income security for a large proportion of General Motors employes. It was felt that by using the resources of the Corporation as an income-stabilizing factor it would be possible to give a large proportion of our employes a greater degree of economic security than has heretofore been available in the automobile industry. The plans were in effect throughout 1939 and more than 34,000 employes took advantage of them, receiving wage advances in excess of $1,500,000, about 90 per cent of which already has been liquidated, the corporation reports.

These plans have been extended for the year 1940, modified in certain particulars. The more important changes in the plans for 1940 as compared with 1939 are as follows:

The 1940 plans provide that any advance remaining unearned or unrepaid at the expiration of three years from the date such advance is made shall be automatically cancelled and the employe shall be relieved of the obligation to earn or work out such advance after the termination of such three-year period.

Since, after Jan. 1, 1940, employes past the age of 65 will become eligible upon retirement for old age benefits under the Federal Social Security Act, employes past their sixty-fourth birthday will not be eligible for advances under these plans during the year 1940.

The total amount of advances which may be outstanding as unpaid or unearned for any one employe under the Income Security Plan at any one time, including unpaid and unearned advances under the 1939 Employe Benefit Plans, has been limited to 360 hours' earnings at the employe's most recent rate of pay.

It should be noted that these advances are not the usual loan of money. They are compensation for services to be rendered in the future. They do not bear interest. As in the 1939 plans, they will be cancelled in the event of the employe's death.

New Passenger Car Registrations

	November 1939	October 1939	November 1938	ELEVEN MONTHS 1939	ELEVEN MONTHS 1938	Per Cent Change, 11 Months 1939 over 1938
Chevrolet	59,520	25,246	52,852	533,522	413,205	+ 29.0
Ford	46,005	34,500	28,672	436,211	325,774	+ 34.1
Plymouth	11,772	37,566	32,687	331,932	251,636	+ 32.0
Buick	26,863	23,522	19,385	194,410	147,934	+ 31.7
Dodge	3,570	13,773	11,028	166,809	87,840	+ 90.0
Pontiac	17,741	14,180	12,158	141,328	84,817	+ 66.8
Oldsmobile	16,780	13,188	11,382	129,615	78,377	+ 65.2
Studebaker	8,741	8,576	5,077	76,238	37,113	+ 105.5
Chrysler	2,184	6,183	4,345	60,262	39,732	+ 51.8
Mercury	6,661	4,321	2,317	58,416	2,317	+2421.0
Hudson	8,671	8,240	4,718	55,184	36,200	+ 52.3
Packard	7,969	8,286	4,857	55,147	44,953	+ 22.9
Nash	4,844	4,283	1,909	49,273	28,119	+ 75.1
De Soto	2,019	4,727	3,257	49,037	30,431	+ 61.0
La Salle	2,736	1,541	2,235	19,731	13,363	+ 48.0
Lincoln	1,903	1,271	1,455	17,817	15,084	+ 28.1
Willys-Overland	2,107	1,864	805	12,917	11,895	+ 8.8
Cadillac	1,267	960	1,258	11,611	9,241	+ 26.0
Graham	60	142	308	3,612	3,733	− 3.2
Bantam	69	101		1,145		
Crosley	58	51		1,112		
Hupmobile	13	20	39	900	958	− 6.1
Fiat	2	3		79		
Miscellaneous	16	42	109	525	1,326	− 60.4
Total	231,571	212,586	200,853	2,406,833	1,664,048	+ 44.5
Chrysler Corp.	19,545	62,249	51,317	608,040	409,639	+ 48.4
Ford Motors Corp.	54,569	40,092	32,444	512,444	343,175	+ 49.5
General Motors Corp.	124,907	78,637	99,270	1,030,217	746,937	+ 38.0
All Others	32,550	31,608	17,822	256,132	164,297	+ 56.0

PUBLICATIONS

Black & Decker Mfg. Co. has issued its 1940 catalog which covers completely its entire line of **portable electric tools.** Particular attention is called to two recently improved drills.*

Catalog No. 50-1 of Audubon Wire Cloth Corp. covers its line of Audubon Metalwove Belts, **conveyor and processing belts** which can be obtained in any ductile metal most resistant to various operating conditions.*

Bulletin T-9, revised as of November, 1939, by the development and research division, International Nickel Co., Inc., discusses the **engineering properties of "K" Monel.***

To show some of the specialized temperature measuring problems to which **Rayotube detectors** are now being applied, Leeds and Northrup Co. have issued a catalog "Micromax and Speedomax Rayotube Pyrometers".*

Aluminum portable gravity conveyors is the subject of a booklet prepared by Aluminum Ladder Co.*

Three new circulars on its **fire extinguishers** have been released by Pyrene Manufacturing Co.*

Airzone, Ltd., Sydney, Australia, has issued a folder describing and illustrating its line of Australian built **ignition coils.***

(*Turn to page* 86, *please*)

R. M. Hidey

Robert M. Hidey, manager of the Dodge truck plant of Chrysler Corp., died in Detroit, Jan. 2. He was in charge of the experimental division of Packard Motor Car Co. for some time and was also manager of the company's truck division until Packard stopped making trucks. For several years he was with White Motor Truck Co., and about five years ago came to Chrysler.

Casing Shipments in November Fell 3.7%

Shipments of automotive casings during November, 1939, are estimated to have been 4,243,791 units. This was 18.2 per cent lower than the 5,187,942 units shipped during October and 3.7 per cent under shipments for November, 1938, according to statistics released by the Rubber Manufacturers Association, Inc.

Replacement shipments declined seasonally during November to 2,296,164 units. This was 29.1 per cent less than October replacements and 9.8 per cent under replacement shipments for November, 1938.

Shipments of casings for original equipment purposes are estimated to have been 1,822,978 units, an increase of one per cent over October and 2.6 per cent over November, 1938.

Export shipments are estimated to have been 124,649 units for November which compares with 144,465 units for October and 83,523 units during November, 1938.

November production, estimated at 4,866,753 units, was 10.4 per cent lower than October and 17.6 per cent more than November, 1938. This was greater than for any November since 1928.

CALENDAR

Conventions and Meetings

SAE Annual Meeting & Engineering Display, Book-Cadillac Hotel, Detroit .....Jan. 15-19

National Automobile Dealers' Association, Annual Convention, Washington, D. C. .....Jan. 22-25

American Road Builders' Association, Convention, Chicago ....Jan. 29-Feb. 2

SAE National Aeronautic Meeting, Washington .....Mar. 14-15

SAE National Transportation & Maintenance Meeting, Pittsburgh.Mar. 28-29

Chamber of Commerce of the United States, Annual Convention, Washington, D. C. .....April 30-May 2

SAE Summer Meeting, White Sulphur Springs, W. Va. .....June 9-14

American Society for Testing Materials, Annual Convention, Atlantic City, N. J. .....June 24-28

Shows at Home and Abroad

National Motor Boat Show, Grand Central Palace, New York .....Jan. 5-13

Leipzig Trade Fair, Germany, March 3-10,1940

They Wait

Some of the thousands of trucks lined up at the New York Foreign Trade Zone, a free port, on Staten Island awaiting shipment to Europe after being purchased by France. Crates on trucks hold spare parts, canvas coverings and machine gun mountings.

Acme

Motor Boat Show Opens 35th Exhibit

The 35th annual National Motor Boat Show opened the evening of Jan. 5 in Grand Central Palace, New York, running through Jan. 13. More than 200 manufacturers were represented and the fleet of recreational craft on display numbered in excess of 150, ranging from tiny canoes and sailboats to a 57 ft. motor yacht.

Sweeping changes in design and arrangements of cabin boats and the trend to more vivid colors in both hulls and interiors were innovations. Almost every marine engine manufacturer at the show was reported to have one or more new engines.

V. W. Kliesrath

Victor W. Kliesrath, vice president of Bendix Aviation Corp. died shortly before the Christmas holidays. He was the inventor of the booster brake and patent holder of several other devices in use in the automotive industry. Interested in both automobile and motor boat racing, he was twice the winner of the Gold Cup Trophy speedboat race.

Automotive Exports and Imports for Eleven Months

	NOVEMBER 1939		NOVEMBER 1938		ELEVEN MONTHS ENDED NOVEMBER 1939		1938	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 19,869,581		$ 25,416,941		$ 228,896,040		$ 241,228,021
PASSENGER CARS								
Passenger cars and chassis	10,560	6,240,988	20,079	11,829,772	126,122	77,151,563	140,409	87,150,685
Low price range $850 inclusive	9,319	4,886,257	17,775	9,451,325	112,337	62,572,912	122,820	68,235,134
Medium price range over $850 to $1200	925	903,881	1,923	1,771,873	11,645	11,087,802	14,993	14,498,363
$1200 to $2000	296	395,034	331	488,831	1,803	2,603,999	2,076	3,079,160
Over $2000	20	55,816	50	117,743	337	886,850	520	1,338,028
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	8,976	4,688,910	8,856	4,597,747	103,883	63,163,853	101,965	65,028,182
Under one ton	1,390	575,261	1,671	630,801	15,587	6,484,628	14,851	6,254,176
One and up to 1½ ton	6,888	3,242,610	6,244	2,910,880	73,016	39,136,243	69,706	38,214,377
Over 1½ tons to 2½ tons	392	343,931	583	474,432	11,004	9,731,435	10,787	8,728,322
Over 2½ tons	288	509,698	314	547,760	3,645	7,227,819	5,422	10,682,442
Bus chassis	18	17,410	44	33,874	631	583,728	1,199	1,148,865
PARTS, ETC.								
Parts except engines and tires		4,468,490		4,753,234		38,140,735		41,833,623
Automobile unit assemblies		3,196,281		2,987,569		35,779,015		33,558,576
Automobile parts for replacement (n.e.s.)		388,061		410,305		3,869,900		3,476,603
Other automobile accessories (n.e.s.)		254,588		374,888		5,350,165		5,260,216
Automobile service appliances	858	3,842,615	1,587	1,164,876	15,439	45,386,709	14,383	35,010,473
Airplanes, seaplanes and other aircraft	62	1,208,300	45	2,006,878	926	23,591,014	766	20,055,219
Parts of airplanes, except engines and tires								
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel	50	212,827	48	211,220	502	1,988,757	485	1,986,871
Other stationary and portable								
Not over 10 hp.	1,476	80,040	1,102	69,336	14,291	808,273	14,800	800,965
Over 10 hp.	336	169,334	96	54,396	2,055	1,221,349	3,093	1,395,938
Engines for:								
Motor trucks and buses	2,590	235,752	1,520	161,496	25,314	3,009,661	22,600	2,503,331
Passenger cars	3,026	269,602	3,818	314,551	23,204	2,077,845	35,865	2,923,742
Aircraft	143	1,209,709	107	822,240	1,498	10,652,930	1,181	7,067,096
Accessories and parts (carburetors)		258,846		222,929		2,674,863		2,534,478
IMPORTS								
Automobiles (dutiable)	45	45,489	48	28,667	572	447,598	540	350,730

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

BUSES Little change since last report. Reorganization of Reo will put this producer back in the running probably before Mar. 1 (See news story on page 77).

TRUCKS One leading producer states it expects its 1940 production to be as large as 1937. Production generally far ahead of schedules; this by no means due only to war conditions. All sections of the country showing up well in buying—the Southeast being a little the better.

TRACTORS Price advances which have brightened farm income outlook during recent weeks have material effect on sales. Tractor makers state that farmers' income will show less than seasonal decline and that it will be larger than in corresponding months of preceding year. Tractor makers, like truck builders, are well pleased with present output and outlook is for excellent year.

AUTOMOBILES Car and truck output for first two weeks in January estimated at close to 200,000 units. Total January output should be approximately equal to that of December, and may exceed it slightly. Most producers beginning year with large banks of unfilled orders.

MARINE ENGINES Heavy Diesels continue to lead in production. General conditions reported good with both war orders and domestic responsible. Many new engines displayed at National Motor Boat Show.

AIRCRAFT ENGINES Backlog of unfilled orders reported currently at $680,000,000 compared with $175,000,000 a year ago. Deliveries for 1940 expected to be more than double those of 1939.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basis information, in all cases from official factory sources.

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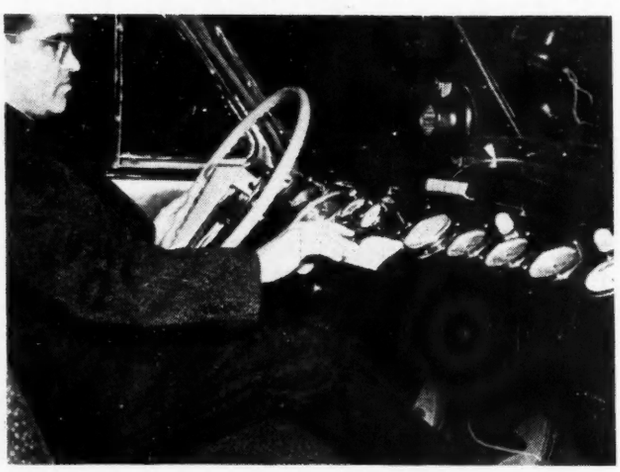
Richfield Equips Fuel Testing Car

At a recent meeting of the S.A.E. Southern California Section, Lawrence J. Grunder, Richfield Oil Company, described an elaborately-equipped test car for testing motor fuels. A photograph of the dashboard equipment of this car, a Cadillac 60 Special, is shown herewith. In the trunk of the car are carried eighteen 2.1-gal. pressure vessels which are filled at the refinery with experimental fuels. After these fuels have been road-tested, the containers are refilled at service stations with commercial gasolines of different brands, which also are road-tested, the remainders being analysed upon return to the refinery.

Referring to the photograph of the instrument board, the large instrument at the left is a Lewis thermo-electric temperature indicator reading in degrees Fahrenheit, which by means of a selector switch at the center of the panel can be connected to one or another of 12 thermo-couples. Above the steering column there is a spark-advance indicator made by Heintz & Kaufman. This newly-developed instrument employs a modified radio circuit in combination with electro-magnetic pick-up units at the flywheel, the pointer showing the spark advance in No. 1 cylinder in crankshaft degrees. Next comes a Stewart-Warner police-type speedometer head with a Bureau-of-Reclamation-type odometer reading to 0.01 mile. Just below this is a round knob for adjusting the spark timing. Above the white button is a Tapley performance meter, which indicates pulling power and grades. Pressing the white button stops the speedometer hand.

The stop watch in the center of the panel is controlled by the push button just below it, which simultaneously engages or disengages the odometer cable. To the right of the black-faced thermo-couple selector swich is the Tycos barometer-altimeter, and then follow in order a pressure gage for the mechanical fuel pump, two intake-manifold gages, and a Visco-Meter.



Test Car

"Wonder" laboratory test car equipped to make laboratory tests on fuels on the road. Shown at the controls is Lawrence J. Grunder, who designed the testing equipment.

MEN . . . . . .

C. M. Vandenburg has been appointed public relations director for Packard Motor Car Co. Most recently Mr. Vandenburg was director of promotion for the 1939 Golden Gate International Exposition in San Francisco.

H. E. Shank has been appointed chief engineer of McCord Radiator and Mfg. Co. He has been in charge of radiator design and development since early in 1938 and now will direct engineering of all products in the McCord line.

W. J. Muler has been appointed Detroit representative for Penn Rivet Corp. Mr. Muller has long been an engine and chassis designer in the automotive industry, one of his more recent developments was the Ruxton front drive car.

W. C. Minkler has joined Young Radiator Co. as assistant sales manager of the catalog products division. **W. A. Starck** has also become associated with Young in a factory management position.

Dr. W. A. Mudge has joined the technical service division of the New York office of International Nickel Co., Inc. For the past 17 years he has been superintendent of research, superintendent of the refinery and works metallurgist at the company's Huntingdon, W. Va., rolling mill.

T. T. Sullivan, secretary and treasurer, and vice-president of Stewart-Warner Corp., has resigned as secretary and treasurer. He will continue in his present capacity as vice-president and director. Ill health and a desire to devote more time to other interests were given as the reasons for the resignation.

Gordon Lee has been appointed Southwestern regional manager in charge of White Motor Bus sales. He will make his headquarters at the White Motor branch in Kansas City.

D. C. Peterson has been appointed plant manager in charge of all manufacturing operations for the Buda Co. He succeeds **E. D. Conant** who recently resigned from his position as vice-president in charge of manufacturing. For the past five years Mr. Peterson has

been associated with Continental Can Co.

W. D. Kirkpatrick, who has been general manager of sales of the American Chain division, has been elected a vice-president of American Chain & Cable Co. He has been with the company for more than 25 years. **C. N. Johns,** a vice-president of American Chain & Cable, has been placed in charge of operations to take over the duties of **C. G. Williams,** a vice-president whose resignation is announced. **G. C. Moon,** a vice-president of the company, has been appointed general manager of sales.

L. J. Kennedy, formerly analytical engineer with Aviation Mfg. Corp., has joined the Godfrey Mfg. Corp. in the same capacity.

R. D. Koenitzer has been elected president of the Koenitzer Engineering Co. He was previously sales engineer with the Young Radiator Co.

W. N. Deisher has been advanced from sales and service manager to manager of Fleet Aircraft, Ltd., Ontario.

W. A. Parrish, formerly engine designer with Caterpillar Tractor Co., has joined the engineering department of Cummins Engine Co.

M. H. Young, formerly test engineer, Wright Aeronautical Corp., has been made assistant project engineer.

W. B. Moore, associated for some 20 years with Timken Roller Bearing Co. in various sales activities, has been appointed director of sales of the steel and tube division.

C. G. Fox has assumed the position of purchasing agent for Pump Engineering Service Corp., division of Borg-Warner Corp. He was previously connected with Marvel-Schebler Carburetor division of Borg-Warner.

War Department Will Accept 'Gyro Designs

The War Department has announced that designs for the construction of rotary-wing aircraft, or autogyro, will be accepted until March 28 under the Government's design competition plan of inviting bids. The aircraft to be procured will be used primarily to determine possible military applications but it was pointed out that the experiments should further its development for additional civil purposes.

The specification governing design resulted from numerous conferences which have been held between representatives of the National Advisory Committee for Aeronautics, the Civil Aeronautics Authority, the Bureau of Aeronautics of the Navy Department and the War Department as contemplated by the Congress in the Act approved June 30, 1938.

Preliminary Statistics of the Automobile Industry for the Calendar Year 1939

Estimates by O. P. Pearson, Chief Statistician, Automobile Manufacturers Association

PRODUCTION AND VALUE	
Car and truck factory sales, U. S. and Canada	3,710,000
Passenger cars	2,960,000
Motor trucks	750,000
Percentage increase over 1938. Motor vehicles	40%
Wholesale value of cars, U. S. and Canada	$1,815,485,000
Wholesale value of trucks, U. S. and Canada	$ 486,071,000
Wholesale value of cars and trucks combined	$2,301,556,000
Wholesale value of parts, accessories and tires for replacement, and service equipment	$1,283,540,000
Motor vehicles, accessories, service equipment and replacements of parts and tires	$3,585,096,000
REGISTRATION	
Motor vehicles registered in U. S.	30,710,000
Motor cars	26,250,000
Motor trucks	4,460,000
World registration of motor vehicles	45,000,000
Per cent of World's automobiles in U. S.	68%
TAXES	
Total motor vehicle user taxes	$1,631,000,000
Gasoline taxes, federal, state and municipal	$1,035,000,000
Percentage motor user taxes to all taxes from all sources, federal, state and local	11%
EMPLOYMENT	
Employment in auto, auto body and parts factories	389,000
Weekly payroll, wages	$ 12,226,000
AUTOMOBILE'S RELATION TO OTHER BUSINESS	
Automotive industry is the largest purchaser of gasoline, rubber, steel, malleable iron, lubricating oil, plate glass, nickel and lead.	
Railroad carloads of automotive freight shipped	3,460,000
Rubber used in automobile industry	80%
Steel used by automobile industry	16%
Lumber, hardwood, used by automobile industry	2%
Copper used by automobile industry	13%
Lead used by automobile industry	33%
Zinc used by automobile industry	10%
Tin used by automobile industry	11%
Aluminum used by automobile industry	12%
Nickel used by automobile industry	25%
Gasoline consumption by motor industry	90%
Gasoline used by motor vehicles (gallons)	20,787,000,000
Gasoline used by motor vehicles, retail value including taxes	$4,050,000,000
MOTOR TRUCKS AND BUSES	
Motor trucks in use	4,460,000
Total special motor truck taxes	$ 421,000,000
Fleets of 8 or more trucks, number of operators	25,116
Trucks operated by fleets of 8 or more	960,000
Number of truck drivers	3,760,000
Motor buses produced	18,000
Motor buses in use	134,000
FOREIGN SALES	
Number of American motor vehicles sold outside United States (U. S. exports and output in Canadian plants owned by U. S. firms)	472,000
Per cent of production sold outside U. S.	12.7%
Value of motor vehicles, parts and tires exported from U. S. and Canada	$ 322,000,000
MOTOR VEHICLE RETAIL BUSINESS	
Total retail outlets, selling vehicles, repair parts, accessories, excluding duplication	94,494
Total repair shops (included above)	86,709
Total new car and truck dealers (included above)	40,599
Wholesalers	6,176
Retail gasoline outlets	400,000

Want Boards

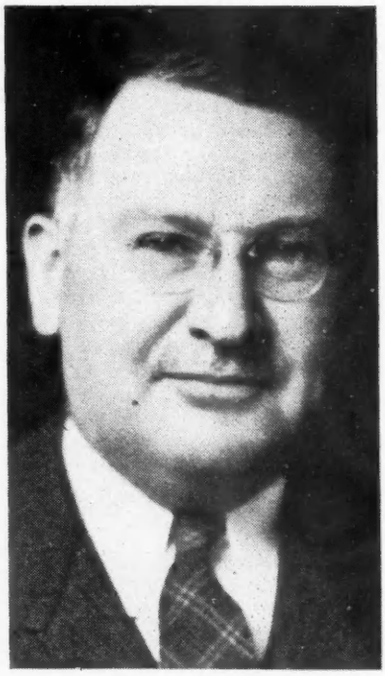
Although all the new 1940 Hudson cars are available with or without running boards at no extra cost, as the buyer prefers, the American motorist seems to prefer running boards on his car.

At the beginning of the 1940 season the buyers' choice was fairly evenly divided, but during the last two months running boards have gained steadily in favor so that now more than 75 per cent of Hudson buyers specify them.

BOOKS . . . .

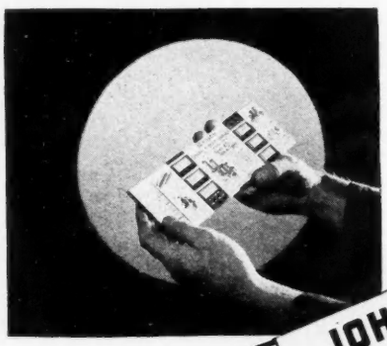
Motor und Kraftstoff (*Engine and Fuel*). *Published by VDI Verlag, G.m.b.H. Berlin NW 7, Germany.*

This publication contains the papers and discussion presented at the Scientific Fall Meeting of the Verein Deutscher Ingenieure in Augsburg in 1938. That meeting was held to mark the fortieth anniversary of the invention of the Diesel engine. The papers deal largely with engine fuels and with problems of engine design.



Howard A. Lewis

. . . recently elected a vice-president of Nash-Kelvinator Corp. For the past ten years he has been treasurer of the corporation and is considered to be one of the leading financial experts in the automotive industry. He is succeeded by G. V. Egan, who has been assistant treasurer for the past twelve years.



SLEEVE BEARING SLIDE RULE

for ENGINEERS DESIGNERS MACHINERY BUILDERS

Our new catalogue lists and describes the most complete bearing service available. Ask for your copy.

● The trend in manufacturing today is definitely towards standardization of parts and materials. Builders know from experience that this is the *one* satisfactory method of securing economy and easy replacement.

It is now an easy matter to standardize on your sleeve bearings. We have produced a new slide rule that lists over 800 sizes of General Purpose standard stock size bearings. This ingenious device is extremely simple to operate. You start with your shaft size . . . move the slide . . . and the desired combination of inside diameter, outside diameter and length instantly appears. All of the bearings so listed are cast in S.A.E. 64 and instantly available from stocks in every principal industrial center.

This slide rule is offered to you without cost or obligation. Simply write us — *on your business letterhead* — and the rule will go forward by return mail.

JOHNSON BRONZE

Sleeve BEARING HEADQUARTERS

625 S. MILL STREET · NEW CASTLE, PA.

Has Unionism Anything to Sell Us?

(*Continued from page* 48)

the Wagner Act and its interpretation by the National Labor Relations Board. We may even hope that something will be done as well about unionism's use of methods which are counter to common law.

If it could offer us a clearly constructive program that is both economically and democratically sound and could show us that that program could be and would be carried out with the employment of only legal and unobstructive methods, unionism could throw away its clubs. It would not need them.

Publications

(*Continued from page* 82)

Catalog No. 15, issued by the Shafer Bearing Corp., Chicago, Ill., contains complete engineering data on Shafer **radial-thrust roller bearings** and self-alining units for a full range of industrial and machine applications. Feature of the catalog is a separate section dealing with engineering data of value to plant engineers.*

Catalog G-1, newly published by Coffing Hoist Co., illustrates and gives specifications covering the company's line of hoists.

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Leaders' Outlook Is Optimistic

(*Continued from page* 62)

of business encourages an optimistic outlook for 1940, particularly with the leadership provided by the automotive industry."

William O'Neil, president, General Tire and Rubber Co.—"We are looking forward into a new year that promises a continuation of the business activity that has marked the past months. There should not be a drop of more than five per cent in the total volume of tires in 1940 as compared to 1939. Moreover, the expected increase in the heavier truck tire sizes will probably mean that the total tire tonnage in 1940 will be as great, or greater, than in 1939, in spite of a possible slight drop in units manufactured."

Edsel Ford, president, Ford Motor Co.—"For 1940 the outlook is definitely favorable. From the branches and dealers we continue to receive evidence that business in general will be good throughout the country. . . . Another encouraging indicator is that the number of used cars in the hands of our dealers is unusually low for this season of the year."

Paul G. Hoffman, president, Studebaker Corp.—"I am optimistic about the prospects for the automobile industry in 1940. Since no recovery in automobile production has ever before ended in one year, the history of cyclical movements encourages us to look for a continuation of last year's improvement. . . . The company enters 1940 with the largest bank of unfilled orders it has ever had on its books at the start of a new year. We expect to be able to maintain production and employment at least at the rate of the last several months."

H. J. Klingler, general manager, Pontiac Motor division, General Motors Corp.—"Our dealers do not yet have normal inventories of cars, and besides that we have the largest number of unfilled orders we have ever had on January first. . . . It is both difficult and unwise in this business to make long range predictions, but unless some unexpected unfavorable developments come along in the economic or international picture, I believe Pontiac will build and sell about 30 per cent more cars in 1940 than in 1939."

Nicholas Dreystadt, general manager, Cadillac-LaSalle—"We are confident 1940 will be one of our most successful sales years. . . . The uptrends of various indices impart a feeling of optimism for the new year. In combination they mean a widely expanded business and, to us, more 1940 automobiles in the hands of consumers."

Ford Output Hits Top Since June '37

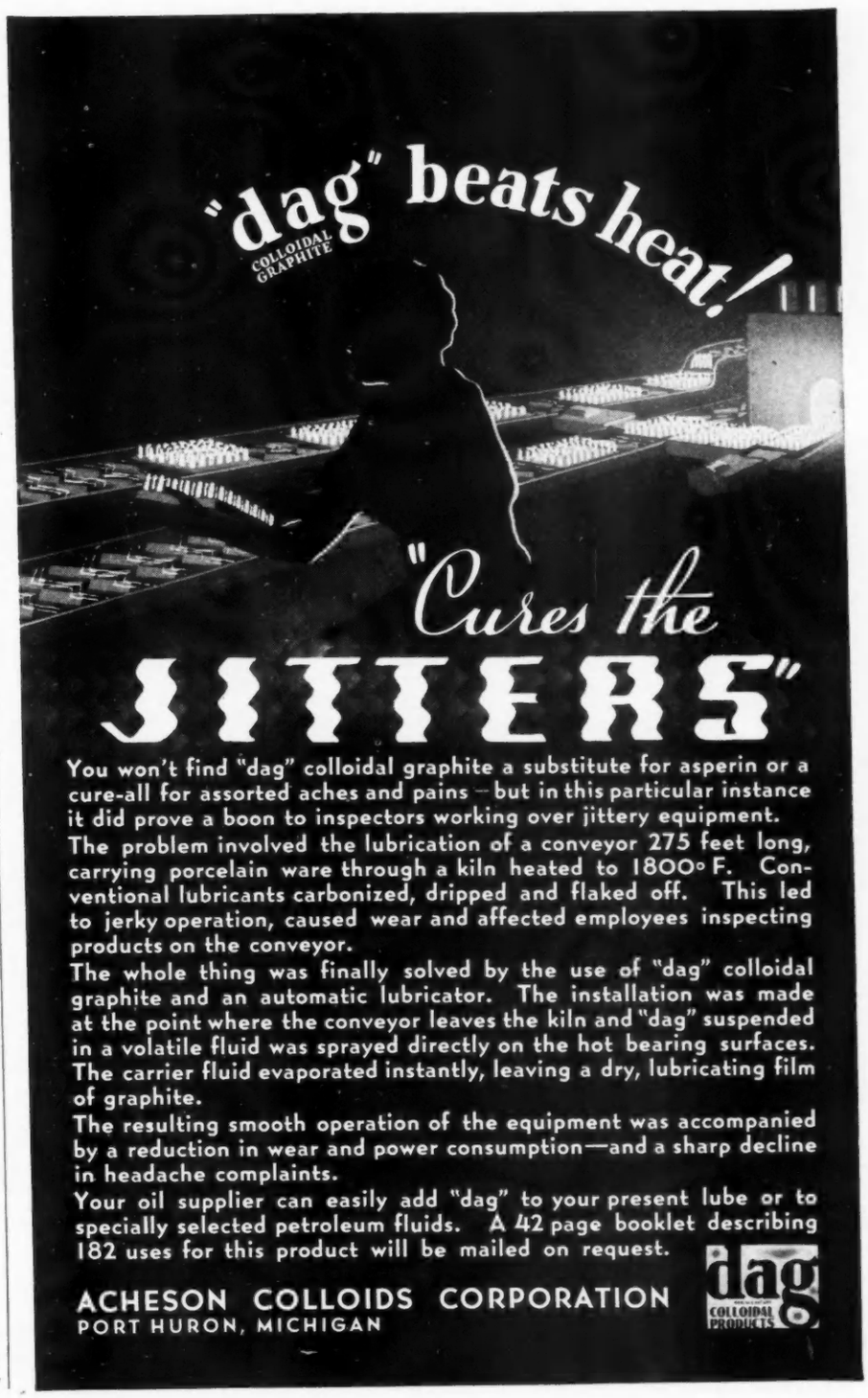
The Ford Motor Co.'s December production was the largest for any month since June, 1937, it was announced by company officials. The company produced a total of 92,389 units—Ford cars and trucks and Mercury cars.

It was also announced that the company's domestic output of cars was 215,120 more in 1939 than in 1938. The major part of this increase came with the production of the 1940 Ford and Mercury cars.

Mercury production also established a record during the month, soaring more than 2,000 units above the best previous month since this new car was introduced 15 months ago. December production of the 1940 Mercury cars was 12,006.

H. L. Warner

Hugh L. Warner, 72, died recently at his home near Detroit. Mr. Warner was a draftsman and inventor who, as a young man, founded the Warner Gear Works which later became the Muncie Gear Works. Early in the century he patented a sliding gear shift and about the same time went to work with the Ford Motor Co. as a draftsman. Sixteen years ago his eyesight failed and from then until his death he was employed at special work in the Ford Rouge plant.


"dag" beats heat!
COLLOIDAL GRAPHITE
"Cures the
JITTERS"
You won't find "dag" colloidal graphite a substitute for asperin or a cure-all for assorted aches and pains—but in this particular instance it did prove a boon to inspectors working over jittery equipment.
The problem involved the lubrication of a conveyor 275 feet long, carrying porcelain ware through a kiln heated to 1800° F. Conventional lubricants carbonized, dripped and flaked off. This led to jerky operation, caused wear and affected employees inspecting products on the conveyor.
The whole thing was finally solved by the use of "dag" colloidal graphite and an automatic lubricator. The installation was made at the point where the conveyor leaves the kiln and "dag" suspended in a volatile fluid was sprayed directly on the hot bearing surfaces. The carrier fluid evaporated instantly, leaving a dry, lubricating film of graphite.
The resulting smooth operation of the equipment was accompanied by a reduction in wear and power consumption—and a sharp decline in headache complaints.
Your oil supplier can easily add "dag" to your present lube or to specially selected petroleum fluids. A 42 page booklet describing 182 uses for this product will be mailed on request.
ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN
dag
COLLOIDAL PRODUCTS

New Developments-Automotive Materials

(*Continued from page 73*)

Not rubber, but solutions of Thermoprene, a patented thermoplastic made by chemical alteration of rubber, the cements when dried form tough, horny films. They are described as translucent, amber liquids of light engine oil consistency.

According to the manufacturer the strength of bond ranges from 10 to 500 lb. per sq. in., depending upon the method of application and the materials joined. The cements resist cracking by bending, shock, or variations in temperature, have chemical resistance better than rubber itself, do not absorb moisture nor swell in water.

Cobalt and Nickel-Base Alloys

Further standardization by machine tool manufacturers on cobalt-chromium-tungsten alloy tools occurred during 1939; and wear strips for boring bars and other machine shop equipment are now made of the same alloy composition as the cutting tools. These alloys have also invaded new fields through the increased use of hard-facing as a means of prolonging the life of wearing parts of machinery.

Several machine tool manufacturers are equipping their new lathes, boring mills, and milling machines with cobalt-chromium-tungsten cutting tools, known as Haynes Stellite "2400" alloy. Tool holders have been developed to accommodate the smaller and more economical sizes, smaller tool bits are being used in many cases, with resultant savings in tool costs.

Standard wear strips, consisting of steel bars to which is brazed wear-resistant cobalt-chromium-tungsten alloy, increase accuracy and service life for boring, driving, and pilot bars used in metal-cutting operations. The Haynes Stellite wear strips also are said to be useful as wearing plates for jigs and fixtures, for indexing stops or locks, and for permanent gaging surfaces, sliding T-slot surfaces and other surfaces requiring high resistance to abrasive wear.

USE IT to find NEW WAYS TO SAVE . . .
LAMINUM SHIM APPLICATION CHART
In factory assembly and service adjustments
● This new chart classifies approved uses of LAMINUM shims and shim stock throughout a score of industries . . . from aviation to diesels. With nearly fifty photographs of applications, it demonstrates the latest methods in factory assembly and service adjustments. The chart will show you what savings and precision are now made possible by LAMINUM . . . the "solid" brass shim that simply P-E-E-L-S for accurate adjustment—right at the job. Your choice of .002 or .003 inch laminations. (A Laminum sample will be mailed you together with the chart.)
LAMINATED SHIM CO., INC., 21-88 44th Ave., L. I. City, New York, N. Y.
CLEVELAND DALLAS HOUSTON LOS ANGELES MILWAUKEE TULSA
1527
THE SOLID SHIM THAT LAMINUM TRADE MARK peels FOR ADJUSTMENT

NLRB Investigation

(*Continued from page 78*)

Fisher No. 23, Fisher No. 21, Fisher No. 37, Fisher No. 40, Fisher No. 49-Export, Fisher No. 27-6, GM Styling Division, Ternstedt, Fleetwood, Chevrolet Gear & Axle, Chevrolet Experimental, Chevrolet Forge, Cadillac Motor Car Co., all of Detroit.

Yellow Truck & Coach, Fisher Body, Pontiac Motors of Pontiac, Chevrolet, Fisher No. 1, AC Spark Plug, Fisher No. 2 of Flint and Saginaw Steering Gear, Malleable Iron Foundry, Chevrolet Service, Chevrolet Grey Iron Foundry and Chevrolet transmission of Saginaw.

Chevrolet Parts, Bay City; Oldsmobile, Lansing; Fisher, Cleveland; Winton Engine, Cleveland; Chevrolet Transmission, Toledo; Chevrolet Commercial Body, Indianapolis; Guide Lamp, Anderson; Chevrolet, Muncie; Delco Battery, Muncie; Chevrolet, Tarrytown; Fisher, Tarrytown; GM Assembly, Linden; Chevrolet, Baltimore; Fisher Body, Baltimore; Chevrolet, Atlanta; Fisher, Atlanta; Chevrolet and Fisher of St. Louis; Harrison Radiator, St. Louis; Chevrolet Truck and Fisher body of Oakland; GM Assembly, Southgate; Chevrolet and Fisher Body of Buffalo; Harrison Radiator, Lockport, N. Y.; Chevrolet and Fisher, Janesville; Chevrolet and Fisher, Kansas City; Fisher Body Plant No. 27, Detroit.

New Departure Manufacturing Division of General Motors Corp., Bristol, Conn.; New Departure Manufacturing Division of General Motors Corp., Meriden, Conn.; Allison Engineering Corporation Division of General Motors, Speedway City, Ind.

MEN and MACHINES

(*Continued from page 71*)

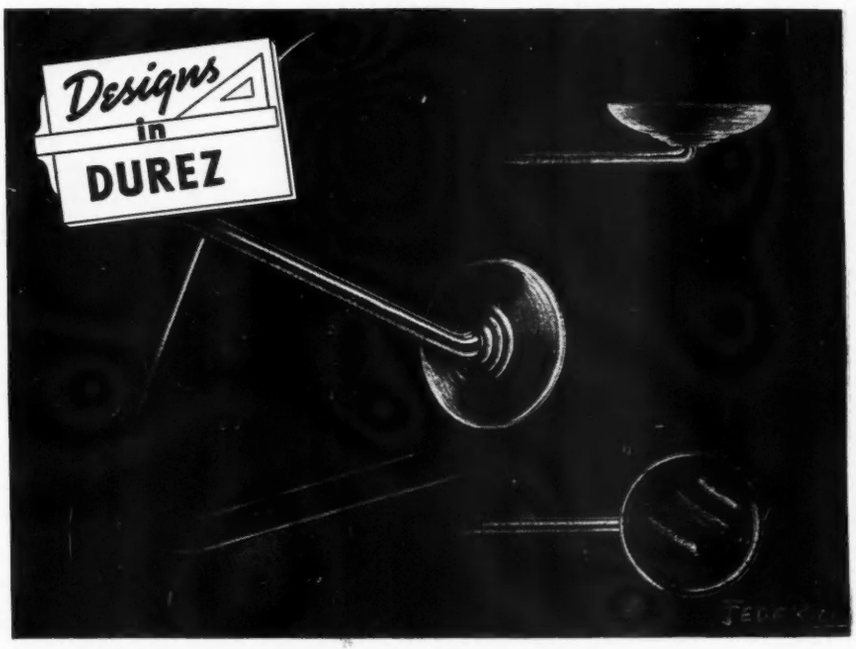
dle speeds up to 12,000 r.p.m. are possible. Tool setting is done by means of patented micrometer screws on which backlash is taken up by spring pressure. Accuracy limits within 0.0002 in. can be maintained.

A motion picture of a Tornos automatic in actual operation has been produced for loan to assoications interested in screw machine work and for groups of plant executives who may wish to determine how the Tornos can be applied to their own screw machine problems. The film may be used on any standard 16 mm. home movie projector and may be obtained without cost or obligation. Requests for the film addressed to *Men and Machines* will be forwarded promptly to the Scherr company.

THE McKenna Metals Co., Latrobe, Pa., has announced a new series of milling cutters equipped with Kennametal-tipped blades, which have been developed in cooperation with the McCrosky Tool Corp., Meadville, Pa. The new series comprises nine standard sizes in each of the following types of cutters: Medium duty face mills, heavy duty face mills and shell end mills. Incorporated in these milling cutters are features developed by McCrosky engineers which are said to be particularly advantageous when using blades tipped with the hard carbide material, Kennametal. The "Jack-Lock Wedge" locks the blade with rigidity and may be locked and unlocked without pounding, thus avoiding damage to the blades. In addition, the adjusting screw in back of each blade permits fine and accurate forward adjustment that holds to a minimum the amount of carbide material which must be removed to align all blades when regrinding. Blades may be moved forward as little as 0.002 in. These design features are shown in the 18-blade facing mill illustrated on this page.

This 18-blade facing mill is one of a new series of milling cutters equipped with Kennametal-tipped blades which has been developed by McKenna Metals Co. in cooperation with the McCrosky Tool Corp.

SEVERAL additional new product offerings which have been brought to the attention of *Men and Machines* are as follows: A new type of hydraulic flanging press developed by the Watson-Stillman Co., Roselle, N. J. Of 1500 metric tons rated capacity, the press has three single-acting moving-down cylinders—one of 1000 metric tons capacity, and two of 250 metric tons capacity each. Two pullback cylinders are of 51 metric tons capacity each, and a horizontal double-acting cylinder has a capacity of 250 metric tons. Stroke of the main cylinders is 59 in.; that of the horizontal cylinder, 6 ft. 7 in. Dimensions of the moving platen are 8 ft 2⅜ in. by 6 ft. 6¾ in.; the bottom platen measures 14 ft. 9 in. by 12 ft. 5⅝ in., and the horizontal ram face 24 in. by 19¾ in. . . . The "Air Master," a self-contained dust collecting unit designed for use with all makes of grinders and buffers having exhaust outlets. Cincinnati Electrical Tool Co. is the manufacturer. . . . Line



How to weatherproof . . .

A REAR-VISION MIRROR

Weather is the worst foe of the outside rear-vision mirror. Rain and snow, heat and cold all conspire to give it a daily beating. Yet it occupies such a prominent place that when it becomes rusted or corroded it "sticks out like a sore thumb."

Herewith, Joseph B. Federico suggests a practical way to prevent this condition—and produce a better looking mirror in the bargain! Simply mold frame and mounting of lustrous, durable Durez plastics. You'll get a fitting that not only defies rust and corrosion, but blends with any body colors as well. One that can be produced easily, too . . . molded and finished in one or two rapid operations.

May we tell you more about this and many other interesting Durez plastics applications for the cars of the future? For information and samples write Durez Plastics & Chemicals, Incorporated, 541 Walck Road, North Tonawanda, N. Y.

DUREZ PLASTICS & CHEMICALS, INC.

Plastics That Fit The Job

of safety feeders and pickers introduced by the F. J. Littell Machine Co., Chicago. The Littell "res-Vac" patented safety feeder is used for picking up flat-surface materials of various kinds and feeding them into punch presses, at the same time keeping the operator's hands out of the "danger" zone and preventing accidents. The device consists of a pistol-grip handle and a single or double vacuum cup attached to an extension. To operate, the cup is placed on the work, then the trigger is pulled. A strong vacuum is formed in the cup which picks up and securely holds the material handled. Holding power of vacuum is sustianed until the trigger is released, when the material is permitted to drop instantly. H. E. B., JR.

Publications Available On Machine Tools

The complete line of **Atlas machine tools and equipment** is covered in catalog No. 40 published by the Atlas Press Co., Kalamazoo, Mich. Several new attachments and accessories are announced along with the year's design improvements in Atlas lathes, drill presses, arbor presses and shapers.*

Four new catalogs have been brought out by the **Jones & Lamson Machine Co.**, Springfield, Vt. They describe, respectively, the following types of equipment: Nos. 3, 4 and 5 Ram Type Universal Turret Lathes; Nos. 7A-B-D Saddle Type Universal Turret Lathes; Nos. 8A-B-D Saddle Type Universal Turret Lathes; and, the 8-in. Fay Automatic Lathe.*

Ex-Cell-O Corp., Detroit, has released the following four new bulletins: Internal Lapping Machines; Precision Thread Grinders (Styles No. 33 and 33L); Precision Thread Grinders (Style No. 39 Internal); and, Precision Thread Grinders (Style No. 50).*

A **two-light fluorescent fixture** for the general illumination of industrial areas is illustrated and described in a folder prepared by The Miller Co., Meriden, Conn.*

"How to Plan a Materials Handling System" is the title of an interesting pamphlet brought out by the Cleveland Crane & Engineering Co., Wickliffe, Ohio.*

A bulletin (GEA-1546F) on the selection of **arc-welding electrodes** has been published by the General Electric Co.*

A four-page bulletin has been issued which describes the line of **welding helmets and accessory protective equipment** manufactured by the Mine Safety Appliances Co., Pittsburgh, Pa.*

Fundmentals of cutting steel with carbide tools are contained in Engineering Bulletin GT-120 published by the Carboloy Co., Detroit.*

Two new catalogs issued by the Acme Machinery Co., Cleveland, are entitled: **"Acme Modern Threading Machines"** and **"Acme Modern Forging Machines."***

Landis Machine Co., Inc., Waynesboro, Pa., has brought out bulletin No. E-88-1 which describes its **four-spindle semi-automatic threading machine.***

Among the data sheets recently issued by the Gisholt Machine Co., Madison, Wis., are Nos. 32 and 33, entitled, respectively, **"Producing Shift Levers at Low Cost"** and **"Accuracy in Machining Aeroplane Propeller Bushings."***

One of the newest publications brought out by the New Jersey Zinc Co., New York, is entitled **"Zinc Alloy Die Castings in Small Tools."***

Model "C" **lathes** manufactured by the Pratt & Whitney division of Niles-Bement-Pond Co., Hartford, Conn., are described in a brochure issued by that company.*

A 66-page condensed catalog lists the entire Leeds & Northrup line of **instruments** for research and for routine testing in laboratory, plant and field.*

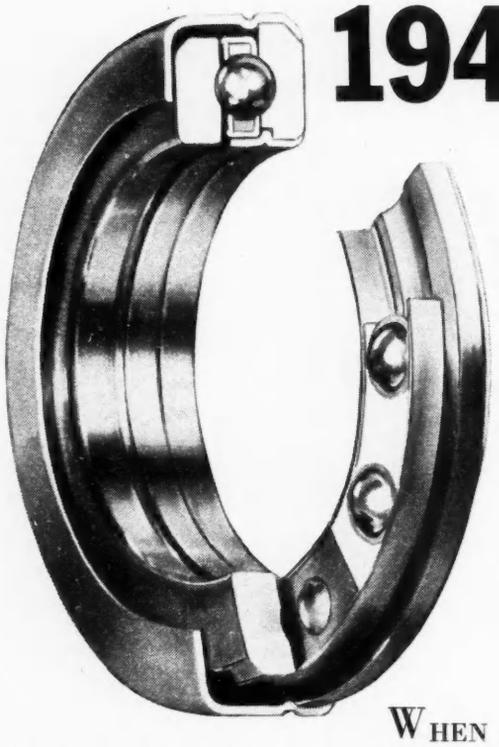
*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Bostitch Co. Wins Engineering Award

Boston Wire Stitcher Co., manufacturers of the Bostitch stapling and stitching machines as well as Bostitch staples, has been notified that it has received the 1939 Industrial Research Citation for its machine for stitching metals. This citation was given Bostitch by the Engineering Societies of New England, and recommended by the cooperation committee of that group and the board of judges, and was approved by the E.S.N.E. executive committee. The award is in keeping with the recent engineering advances made by the Bostitch Company in stapling equipment of all kinds.

Look ahead to

1941...



WHEN you begin to lay down 1941 models on your drafting boards consider well the bearings for the clutch position.

The BCA Prelubricated Clutch Bearing shown here is the most outstanding clutch bearing development in automotive history.

Your 1941 models are entitled to this improvement.

BEARINGS COMPANY OF AMERICA
507 HARRISBURG AVENUE, LANCASTER, PENNSYLVANIA

BCA RADIAL • ANGULAR CONTACT • THRUST **BALL BEARINGS**